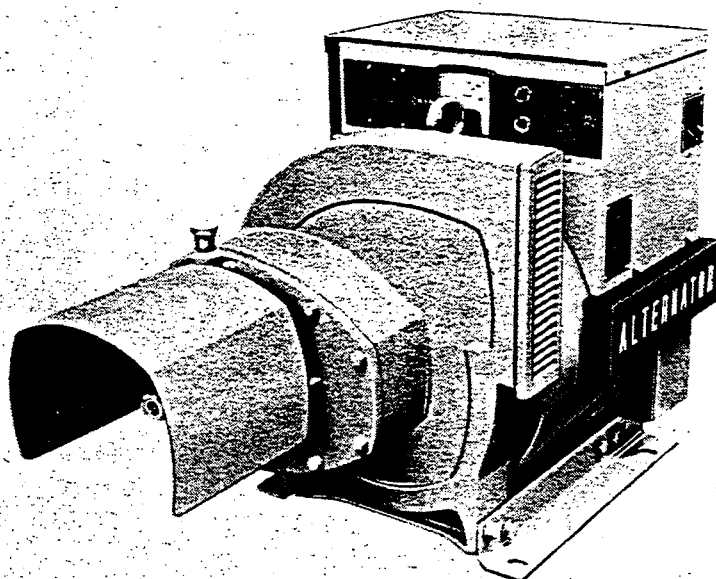


OPERATOR'S MANUAL AND PARTS CATALOG

FOR
YD
SERIES

15, 20, 25, and 30 kW TRACTOR DRIVE ALTERNATORS



SINGLE PHASE - THREE PHASE

FORM NUMBER
929-0002

ISSUE DATE
10-79 (SPEC AA)

Replaces
4-78 (Spec AA)

Printed in U.S.A.

SAFETY PRECAUTIONS

The following symbols in this manual signal potentially dangerous conditions to the operator or equipment. Read this manual carefully. Know when these conditions can exist. Then, take necessary steps to protect personnel as well as equipment.

WARNING This symbol is used throughout this manual to warn of possible serious personal injury.

CAUTION This symbol refers to possible equipment damage.

Study the following safety precautions carefully and insist that they be followed by those working with you and for you.

GUARD AGAINST ELECTRIC SHOCK

- Use extreme caution when working on electrical components. High voltage currents cause injury or death.
- Follow all state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician.
- When working around electrical equipment, move cautiously to avoid shocks.
- Do not lunge after falling tools.
- Stop all power, and ground all high voltage points before touching wires.
- Make certain that power cannot be accidentally restored.
- Be sure power is off if you must work on underground electrical equipment.
- Do not examine live equipment when mentally or physically fatigued.
- Do not touch live electrical equipment while standing on metal floors, damp concrete or other well grounded surfaces.
- Do not handle live electrical equipment while wearing damp clothing (particularly wet shoes) or while skin surfaces are damp.
- Be extra cautious when working with alternator during a rain.

- Do not take unnecessary risks.
- Do not work alone.

EXHAUST GASES ARE TOXIC

- Provide an adequate exhaust system to properly expel discharged gases. Check exhaust system regularly for leaks.
- Be sure the unit is well ventilated.

PROTECT AGAINST MOVING PARTS

- Avoid moving parts of the unit. Loose jackets, shirts or sleeves should not be permitted because of the danger of becoming caught in moving parts.
- Clothing worn by the operator should be fairly tight and belted. Loose jackets, shirts, or sleeves should not be permitted because of the danger of getting into moving parts.
- Do not allow anyone to operate the alternator without proper instructions.
- Make sure all nuts and bolts are secure. Keep power shields and guards in position.
- If adjustments *must* be made while the unit is running, use extreme caution around moving parts, etc.
- Before lubricating alternator always:
 1. Disengage all power
 2. Shut off engine, and then
 3. Wait until rotor stops.

FIRE EXTINGUISHERS

- It is a good practice to have a fire extinguisher nearby. Be sure that the extinguisher is properly maintained and be familiar with its proper use.
- Extinguishers rated ABC by the NFPA are appropriate for all applications. Consult the local fire department for the correct type of extinguisher for various applications.

KEEP THE UNIT AND SURROUNDING AREA CLEAN

- Remove oil, grease, ice, snow or materials that create slippery conditions around unit.
- Remove oily rags and other materials that create potential fire hazards.

Important Safety Precautions

Read and observe these safety precautions when using or working on electric generators, engines and related equipment. Also read and follow the literature provided with the equipment.

Proper operation and maintenance are critical to performance and safety. Electricity, fuel, exhaust, moving parts and batteries present hazards that can cause severe personal injury or death.

FUEL, ENGINE OIL, AND FUMES ARE FLAMMABLE AND TOXIC

Fire, explosion, and personal injury can result from improper practices.

- Used engine oil, and benzene and lead, found in some gasoline, have been identified by government agencies as causing cancer or reproductive toxicity. When checking, draining or adding fuel or oil, do not ingest, breathe the fumes, or contact gasoline or used oil.
- Do not fill tanks with engine running. Do not smoke around the area. Wipe up oil or fuel spills. Do not leave rags in engine compartment or on equipment. Keep this and surrounding area clean.
- Inspect fuel system before each operation and periodically while running.
- Equip fuel supply with a positive fuel shutoff.
- Do not store or transport equipment with fuel in tank.
- Keep an ABC-rated fire extinguisher available near equipment and adjacent areas for use on all types of fires except alcohol.
- Unless provided with equipment or noted otherwise in installation manual, fuel lines must be copper or steel, secured, free of leaks and separated or shielded from electrical wiring.
- Use approved, non-conductive flexible fuel hose for fuel connections. Do not use copper tubing as a flexible connection. It will work-harden and break.

EXHAUST GAS IS DEADLY

- Engine exhaust contains carbon monoxide (CO), an odorless, invisible, poisonous gas. Learn the symptoms of CO poisoning.
- Never sleep in a vessel, vehicle, or room with a genset or engine running unless the area is equipped with an operating CO detector with an audible alarm.
- Each time the engine or genset is started, or at least every day, thoroughly inspect the exhaust system. Shut down the unit and repair leaks immediately.

- Warning: Engine exhaust is known to the State of California to cause cancer, birth defects and other reproductive harm.

Make sure exhaust is properly ventilated.

- Vessel bilge must have an operating power exhaust.
- Vehicle exhaust system must extend beyond vehicle perimeter and not near windows, doors or vents.
- Do not use engine or genset cooling air to heat an area.
- Do not operate engine/genset in enclosed area without ample fresh air ventilation.
- Expel exhaust away from enclosed, sheltered, or occupied areas.
- Make sure exhaust system components are securely fastened and not warped.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not remove any guards or covers with the equipment running.
- Keep hands, clothing, hair, and jewelry away from moving parts.
- Before performing any maintenance, disconnect battery (negative [-] cable first) to prevent accidental starting.
- Make sure fasteners and joints are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- If adjustments must be made while equipment is running, use extreme caution around hot manifolds and moving parts, etc. Wear safety glasses and protective clothing.

BATTERY GAS IS EXPLOSIVE

- Wear safety glasses and do not smoke while servicing batteries.
- Always disconnect battery negative (-) lead first and reconnect it last. Make sure you connect battery correctly. A direct short across battery terminals can cause an explosion. Do not smoke while servicing batteries. Hydrogen gas given off during charging is explosive.
- Do not disconnect or connect battery cables if fuel vapors are present. Ventilate the area thoroughly.

DO NOT OPERATE IN FLAMMABLE AND EXPLOSIVE ENVIRONMENTS

Flammable vapor can be ignited by equipment operation or cause a diesel engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury and death. **Do not operate diesel equipment where a flammable vapor environment can be created by fuel spill, leak, etc., unless equipped with an automatic safety device to block the air intake and stop the engine.**

HOT COOLANT CAN CAUSE SEVERE PERSONAL INJURY

- Hot coolant is under pressure. Do not loosen the coolant pressure cap while the engine is hot. Let the engine cool before opening the pressure cap.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not service control panel or engine with unit running. High voltages are present. Work that must be done while unit is running should be done only by qualified service personnel.
- Do not connect the generator set to the public utility or to any other electrical power system. Electrocution can occur at a remote site where line or equipment repairs are being made. An approved transfer switch must be used if more than one power source is connected.
- Disconnect starting battery (negative [-] cable first) before removing protective shields or touching electrical equipment. Use insulative mats placed on dry wood platforms. Do not wear jewelry, damp clothing or allow skin surface to be damp when handling electrical equipment.
- Use insulated tools. Do not tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches to avoid accidental closure.
- With transfer switches, keep cabinet closed and locked. Only authorized personnel should have cabinet or operational keys. Due to serious shock hazard from high voltages within cabinet, all service and adjustments must be performed by an electrician or authorized service representative.

If the cabinet must be opened for any reason:

1. Move genset operation switch or Stop/Auto/Handcrank switch (whichever applies) to Stop.
2. Disconnect genset batteries (negative [-] lead first).
3. Remove AC power to automatic transfer switch. If instructions require otherwise, use extreme caution due to shock hazard.

MEDIUM VOLTAGE GENERATOR SETS (601V TO 15kV)

- Medium voltage acts differently than low voltage. Special equipment and training are required to work on or around medium voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures will result in severe personal injury or death.
- Do not work on energized equipment. Unauthorized personnel must not be permitted near energized equipment. Induced voltage remains even after equipment is disconnected from the power source. Plan maintenance with authorized personnel so equipment can be de-energized and safely grounded.

GENERAL SAFETY PRECAUTIONS

- Do not work on equipment when mentally or physically fatigued or after consuming alcohol or drugs.
- Carefully follow all applicable local, state and federal codes.
- Never step on equipment (as when entering or leaving the engine compartment). It can stress and break unit components, possibly resulting in dangerous operating conditions from leaking fuel, leaking exhaust fumes, etc.
- Keep equipment and area clean. Oil, grease, dirt, or stowed gear can cause fire or damage equipment by restricting airflow.
- Equipment owners and operators are solely responsible for operating equipment safely. Contact your authorized Onan/Cummins dealer or distributor for more information.

KEEP THIS DOCUMENT NEAR EQUIPMENT FOR EASY REFERENCE.

GENERAL INFORMATION

INTRODUCTION

This instruction book contains information for the proper installation, operation and maintenance of your alternator. We suggest you keep this book handy so it can be referred to when necessary.

If you must contact your dealer or the distributor regarding this equipment, be sure to supply the complete Model and Specification Number and the full Serial Number to identify your equipment.

How to interpret Model and Specification number:

25.0 YD - 3G 1 AA
1 2 3 4 5

1. Kilowatt rating of alternator.
2. Factory code for series identification.
3. Combines with number 1 and 2 to identify model.
 - a. The 3 indicates 120/240 volts, single phase.
 - b. 5D indicates 120/240 volts, three phase.
 - c. G is for gear box.
4. Factory code for optional equipment.
5. Specification letter (advances when factory makes production modifications).

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OPTIONAL ACCESSORIES

Power Take-Off Shaft

Telescoping, shielded, heavy duty power take-off shafts (tumbling rods), recommended for use with PTO powered, gear drive alternators provide maximum safety for the operator. The six spline universal joint with snap ring type shield and quick disconnect feature, fits a 1-3/8-inch (35 mm) tractor PTO drive. The power take-off shaft operating lengths are: minimum 45 inch (1143 mm), maximum 60 inch (1524 mm); weight 35 pounds.

The operating speed may vary from 540-600 rpm depending on the load. The nominal PTO speed is 540 rpm at full load.

WARNING

TO AVOID POSSIBLE PERSONAL INJURY OR EQUIPMENT DAMAGE, A QUALIFIED ELECTRICIAN OR AN AUTHORIZED SERVICE REPRESENTATIVE MUST PERFORM INSTALLATION AND ALL SERVICE.

SPECIFICATIONS

SINGLE PHASE ALTERNATORS

	15.0YD-3G	20.0YD-3G	25.0YD-3G	30.0YD-3G
Starting Watts	37,500	52,000	62,500	80,000
Running Watts	15,000	20,000	25,000	30,000
Volts	120/240	120/240	120/240	120/240
Phase	1	1	1	1
Hertz	60	60	60	60
Current (Amperes)	62.5	83.3	104.2	125
Power Factor	1.0	1.0	1.0	1.0
Wire	4	4	4	4
Brushless	Yes	Yes	Yes	Yes
Alternator Speed (Nominal)	1800	1800	1800	1800
Tractor Speed (Nominal)	540	540	540	540
Minimum Horsepower Required				
Driving Source	30	35	45	55
Gear Box Oil Capacity, Pints	1.0 Pt (0.47 litre)	1.0 Pt (0.47 litre)	1.0 Pt (0.47 litre)	1.0 Pt (0.47 litre)
Gear Lubricant	SAE 90 EP	SAE 90 EP	SAE 90 EP	SAE 90 EP
Weight	354 lbs. (161 kg)	398 lbs. (181 kg)	438 lbs. (198 kg)	483 lbs. (219 kg)

THREE PHASE ALTERNATORS*

	20.0YD-5DG	25.0YD-5DG	30.0YD-5DG
Starting Watts	57,500	70,000	95,000
Running Watts	20,000	25,000	30,000
Volts	120/240	120/240	120/240
Phase	3	3	3
Hertz	60	60	60
Current (Amperes)	60.2	75.4	90.5
Power Factor	0.8	0.8	0.8
Wire	4	4	4
Brushless	Yes	Yes	Yes
Alternator Speed (Nominal)	1800	1800	1800
Tractor Speed (Nominal)	540	540	540
Minimum Horsepower Required, Driving			
Source	35	45	55
Gear Box Oil Capacity, Pints	1.0 Pt (0.47 litre)	1.0 Pt (0.47 litre)	1.0 Pt (0.47 litre)
Recommended Gear Lubricant	SAE 90 EP	SAE 90 EP	SAE 90 EP
Weight	423 lbs. (192 kg)	438 lbs. (198 kg)	512 lbs. (232 kg)

All models are CSA Certified.

*Delta wound, one phase center-tapped to deliver 120/240 volt, single-phase power in capacities to 2/3 of rated 3-phase kVA.

DESCRIPTION

ALTERNATOR DESCRIPTION

The YD series alternators (Figure 1) are four-pole, revolving field, brushless exciter, 1800 rpm models of drip-proof construction. Alternator design includes both single and three-phase, 60 hertz type alternators. The alternator rotor is fastened to the gear case by the rotor through-stud which passes through the rotor shaft, Figure 2.

The end bell and stator housing are attached by four through-studs which pass through the stator assembly to the gear case alternator adapter. The brushless exciter stator mounts in the end bell while the exciter rotor and its rotating rectifier assemblies mount on the alternator rotor shaft. The shaft is supported at both ends by lubricated ball bearings. A centrifugal blower on the drive end of the alternator draws air through the alternator for cooling.

The complete alternator includes a built-in exciter and voltage regulator, mounting feet, lifting eye, mounted gear box and splined drive shaft and control box, which includes voltmeter and a full output load plug.

Gear Box

The gear box and alternator adapter contain two helical gears supported by heavy duty ball bearings. The bearings and gears are lubricated by the gear box oil. The gear box requires 1.0-pint (.47 litre) of SAE 90 EP (extreme pressure) gear lubricant.

Control Box

The control box includes the voltage regulator, voltmeter, 15 amp duplex receptacle with circuit breaker, 50 amp welder receptacle with circuit breakers, a full output load connector with load circuit breakers, and a field circuit breaker. The load circuit breakers can be used as an on-off switch. Alternator power must feed into the farm electrical system through an approved double throw load transfer switch.

OPERATION

The basic operation of the alternator and voltage regulator involves the stator, voltage regulator, exciter field and armature, a full wave bridge rectifier, and the alternator rotor. Residual magnetism in the alternator rotor and a permanent magnet embedded in one exciter field pole begin the voltage build-up process as the alternator set starts running. Single-phase AC voltage, taken from one of the stator windings, is fed to the voltage regulator as a reference voltage for maintaining the alternator output voltage. The AC reference voltage is converted to DC by a silicon controlled rectifier bridge on the voltage regulator printed circuit board and fed into the exciter field windings. The exciter armature produces three-phase AC voltage that is converted to DC by the rotating rectifier assembly. The resultant DC voltage excites the alternator rotor winding to produce the stator output voltage for the AC load.

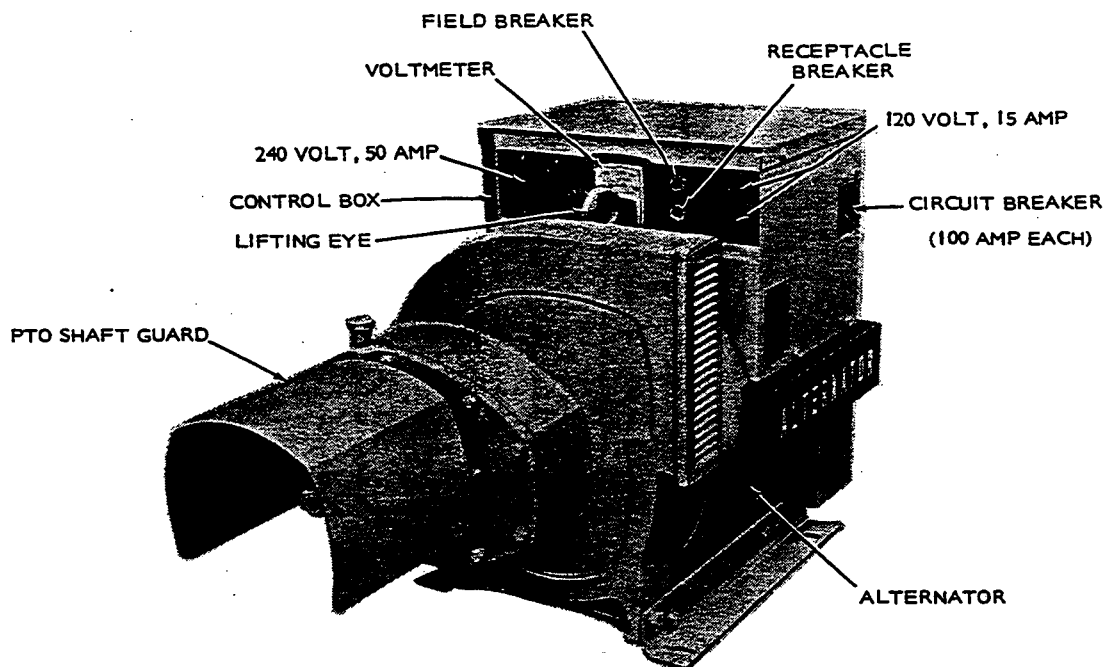


FIGURE 1. PTO-POWERED ALTERNATOR

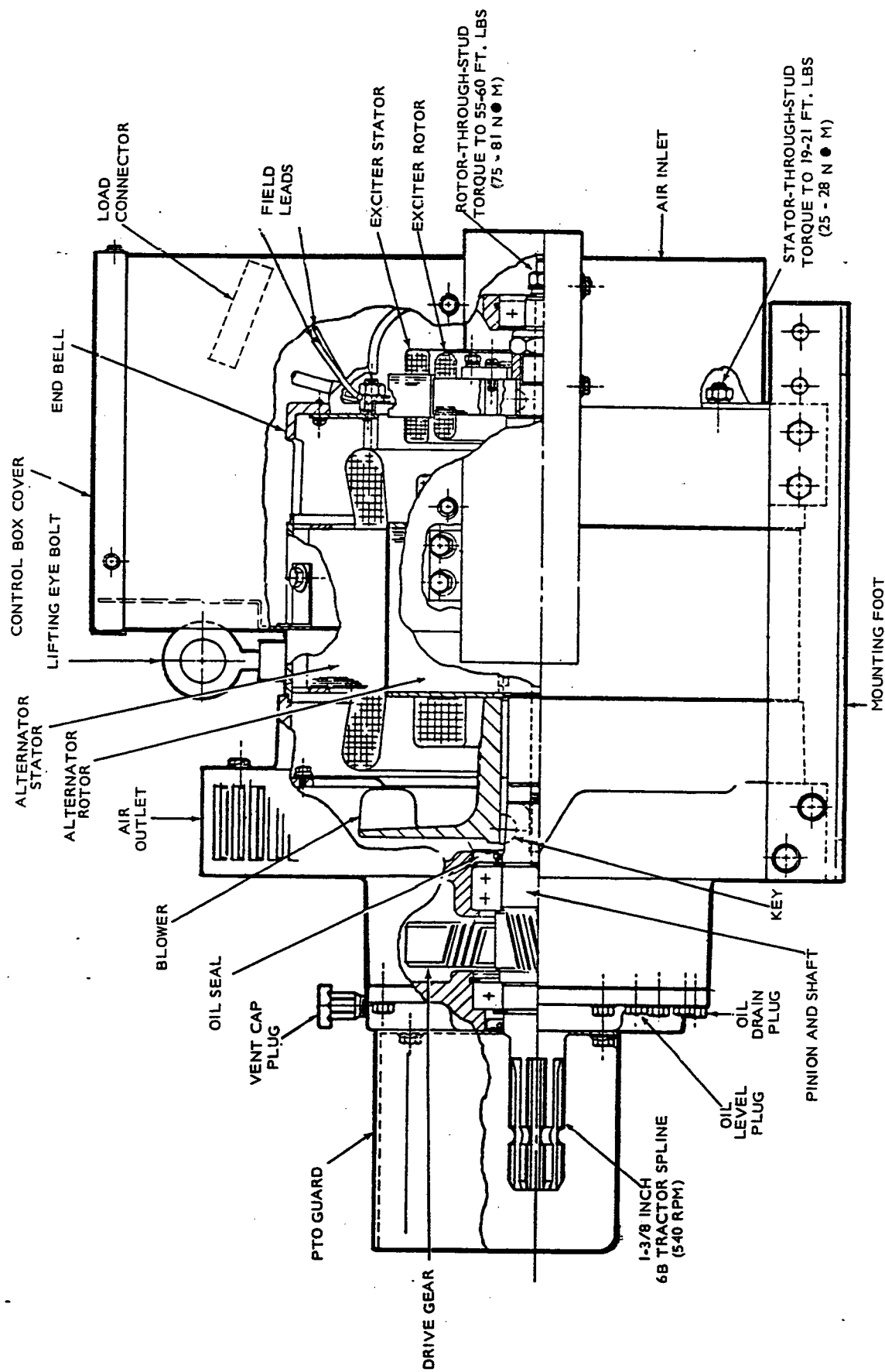


FIGURE 2. YD TRACTOR DRIVE ALTERNATOR

INSTALLATION

LOCATION

Figure 3 shows alternator dimensions and bolt-hole centers for installation. Select a site for the alternator with the following points in mind.

Ventilation

The alternator creates heat when operating under load conditions. It is important that this heat be removed by proper ventilation. If the alternator is installed inside a small room or compartment, provide a vent for exhausting the air heated by the alternator. Locate the heated air exhaust vent above the inlet vent. Heated air is discharged from the drive-shaft end of the alternator.

WARNING Provide an outlet for tractor exhaust if operating inside a building. Exhaust fumes are deadly! See carbon monoxide warning at the end of this section.

Convenience to Driving Power

Locate the alternator for easy connection to the tractor. Align the power take-off to the alternator. Stay within the limits of the tumbling rod.

Dusty or Damp Conditions

Avoid dusty or damp conditions as much as possible. Alternator should be mounted under cover or inside a building to protect it against the weather.

Servicing Convenience

Allow at least 24 inches (610 mm) of space on all sides of the alternator.

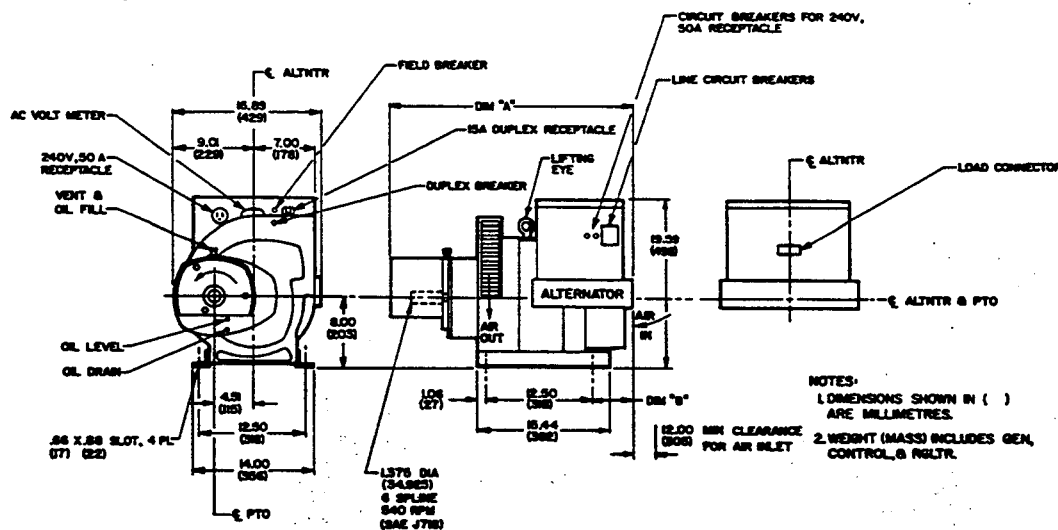
Wiring Convenience

Do not locate the alternator in a location difficult to service or which would have poor ventilation, to save a few feet of wiring. Install the alternator as close to the load transfer switch as possible.

MOUNTING THE ALTERNATOR

Provide a substantial mounting base of concrete, wood or steel. Figure 4 shows dimensions of recommended mounting base. The surface of the base should be level so the alternator mounting feet will not be sprung when tightened down. For trailer mounting use Onan trailer 410-0692.

CAUTION It requires about 45 horsepower at the power take-off to develop 25 kW. Therefore, the torque will flip the alternator over unless secured to a strong substructure. A narrow (30 inch, 762 mm) trailer is not suitable for operation. Forty inch hub-to-hub minimum measurement is required.



UNIT RATING	DIM "A"		DIM "B"		WEIGHT LBS	MASS kg
15.0 YD-G/1AA (10)	29.06	(738)	3.88	(97)	355	161.2
20.0 YD-XG/1AA (10830)	30.50	(755)	5.32	(135)	398	180.5
25.0 YD-XG/1AA (10830)	31.75	(807)	6.57	(169)	435	197.5
30.0 YD-XG/1AA (10830)	33.37	(848)	8.19	(208)	483	219.1

FIGURE 3. INSTALLATION OUTLINE

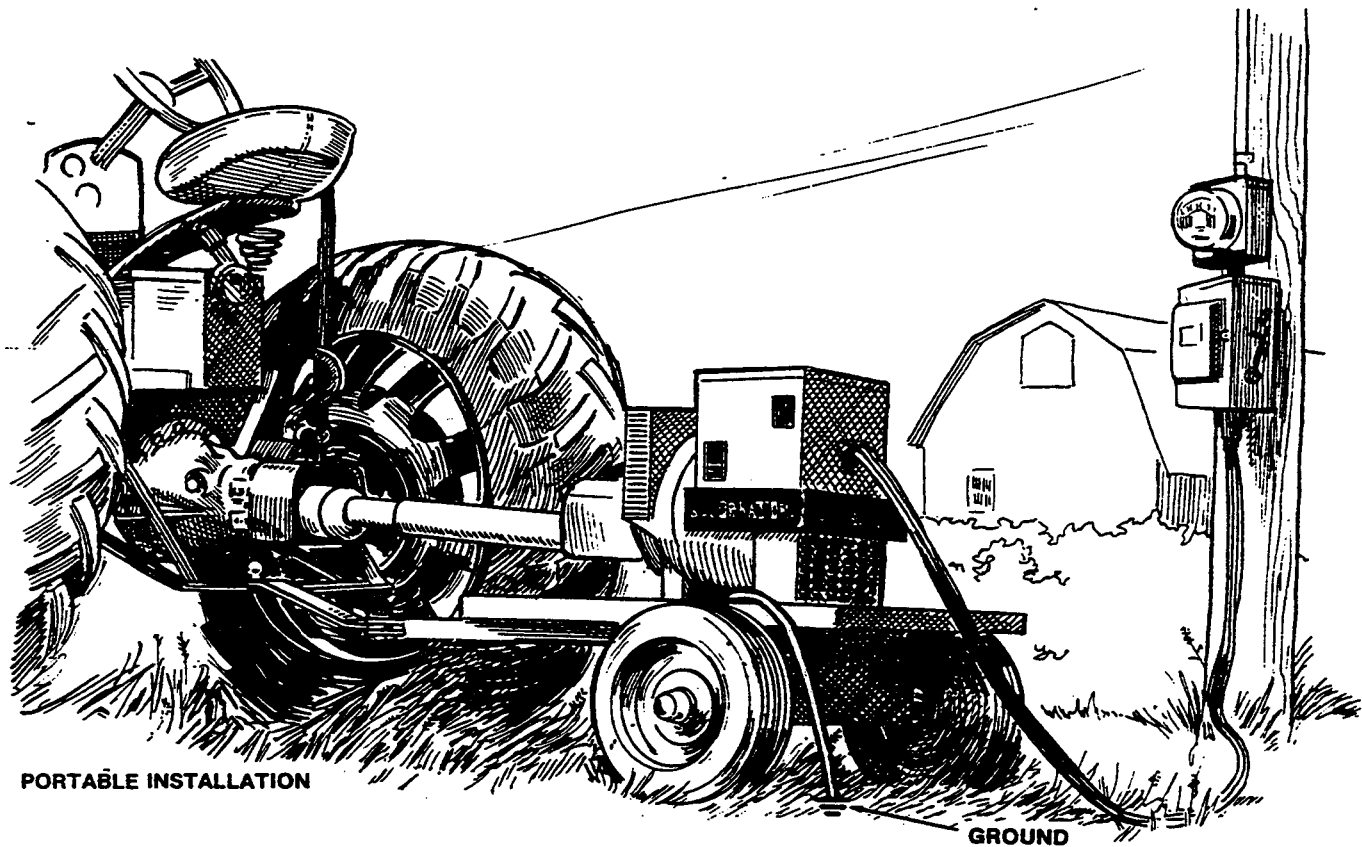
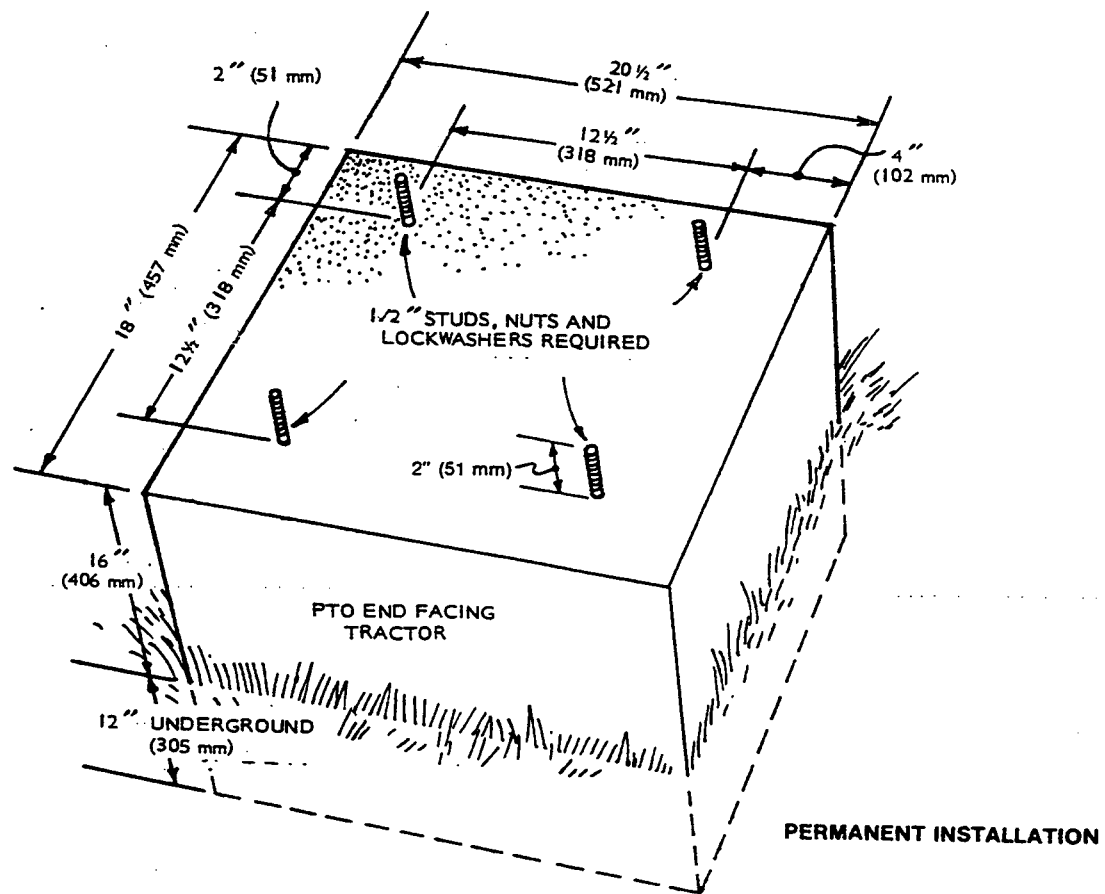


FIGURE 4. RECOMMENDED MOUNTINGS

PTO SHAFT INSTALLATION

Be sure that the tractor is properly aligned (parallel) with the alternator and that it will stay aligned during operation. See Figure 5.

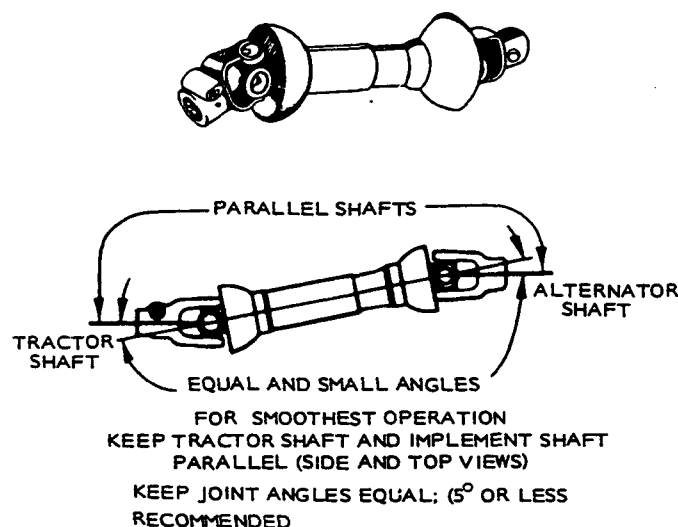


FIGURE 5. PTO SHAFT ALIGNMENT

CAUTION The tractor PTO spline and the alternator input spline must be parallel for smoothest operation with minimum wear in the U-joints on the PTO shaft.

WARNING The protective guards on the rotating PTO shaft are for personnel safety. Exposed U-joints could wind up clothing and cause serious personal injury. The guards may be removed for maintenance, but they must always be in place for safe operation.

The U-joints and the telescoping shafts require grease every 25 hours of operation.

WIRING CONNECTIONS

For wiring connections with alternator mounted on a permanent base, connect load wires from output plug on alternator to load transfer switch. Use weather-protective fittings, couplings and wires throughout.

Recommendations:

- Use flexible conduit and stranded load wires near alternator to absorb vibration. Use sufficiently large insulated wire.
- Connect each load wire connector to the proper output plug position on the control box.
- Insulate bare ends of ungrounded wires.
- Install a load transfer switch between the alternator and load.
- If a test indicates reversed rotation of three-phase motors in the load circuit, reverse the load connections at any two load leads (T1, T2, T3).

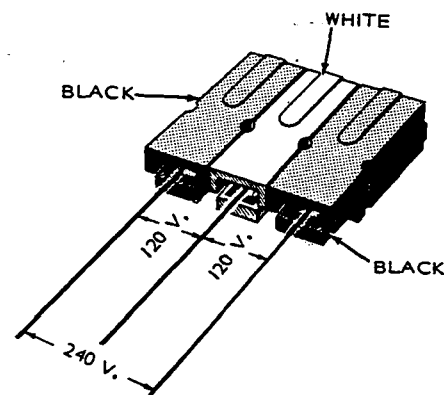


FIGURE 6. 120/240 VOLT, SINGLE PHASE CONNECTION

For portable use (alternator mounted on a trailer), connect load wires from output plug on alternator control box to an approved disconnect plug that can be connected to load transfer switch. Use a flexible power cord so cable can be easily wrapped up when not in use, Figure 6.

Receptacles on alternator control box allow connections when alternator has to be moved to the field or a remote location where no power is available.

SINGLE PHASE ALTERNATORS

With this connection, either 120 volts or 240 volts can be used alone or at the same time. Figure 6 shows a 120/240 volt, single phase connector.

THREE PHASE ALTERNATORS

The 3-phase alternator will supply 240 volts, 3 phase and 120 and 240 volts single phase current, Figure 7. All black terminals are used for 240 volt, three phase. For 240 volt single phase, connections are made between any two (black) three phase terminals. Single phase, 120 volts connect between black and white terminals as shown.

Single phase connector, Figure 6, can be used in a three phase alternator.

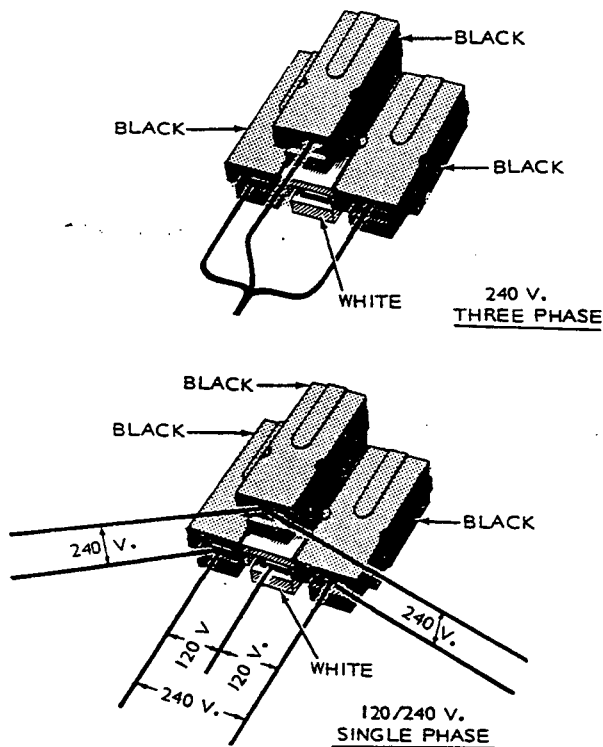


FIGURE 7. THREE PHASE 240 VOLT DELTA CONNECTIONS

CAUTION If no three phase output is used, usable single phase power is 2/3 of three phase kVA. Any overloading above 2/3 may damage the alternator windings.

INSTALLING THE LOAD TRANSFER SWITCH

Before using the alternator for standby purposes, install a **DOUBLE THROW LOAD TRANSFER SWITCH**. The switch must have an ampere rating large enough to carry the total load when the main source of power is in use. Follow the local electrical

code. The load transfer switch should always be installed close to the main line switch, and between the main line switch and the load. When properly installed, the load transfer switch in one position will connect the electrical load to the highline. When the load transfer switch is thrown to the other position, the load is first disconnected from the main source of power, and then connected to the tractor alternator. Using the load transfer switch makes it impossible to connect the alternator to the main source of power. The load lines must connect to the center terminals of the transfer switch. The alternator leads and the main power source leads must be connected at opposite ends of the switch.

POWER RETURN SIGNAL

When the alternator is used for emergency applications, install a pilot light or alarm signal to indicate when the power is restored and when the alternator can be disconnected. Connect a signal light across the regular power line, just ahead of the load transfer switch, Figure 8. Install an on-off switch and a fuse for the signal light. When a power failure occurs, snap the signal switch to the ON position before putting the alternator into operation. When the normal power returns, the signal operates and the alternator can then be disconnected.

COMBINATION SINGLE AND THREE PHASE LOAD TRANSFER CONNECTIONS

Two load transfer switches and additional wiring are required to connect one standby 3-phase alternator in locations where separate 1-phase and 3-phase power lines normally supply the power. A 3-pole, double throw switch alternately connects the 240 volt, 3-phase line transformer power or the 240 volt, 3-phase alternator motor loads. A 2-pole, double throw switch alternately connects the 120/240 volt, 1-phase line transformer power or the 1-phase alternator power to the 120 volt and 240 volt loads. The alternator and load transfer switches should be located close to the power line transformer which carries the heavier load. Separate power lines must be installed to carry power from the alternator to the lighter loads, Figure 9.

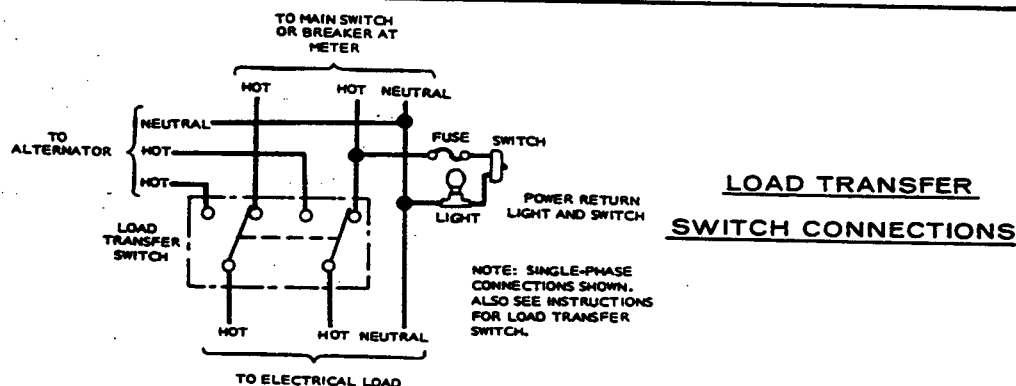
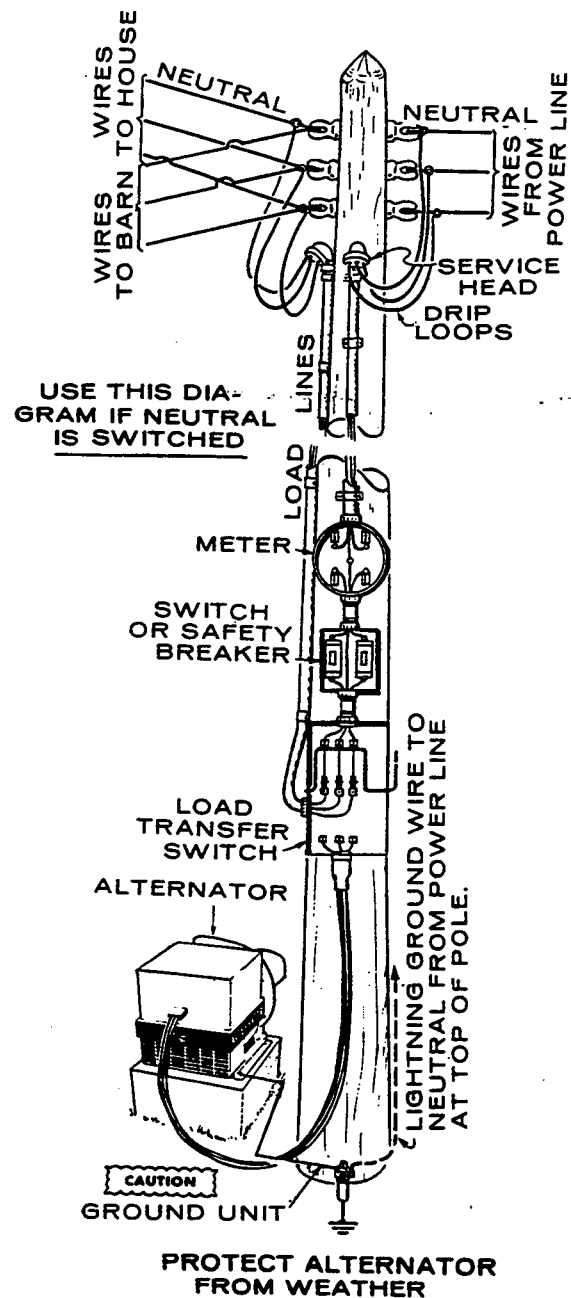
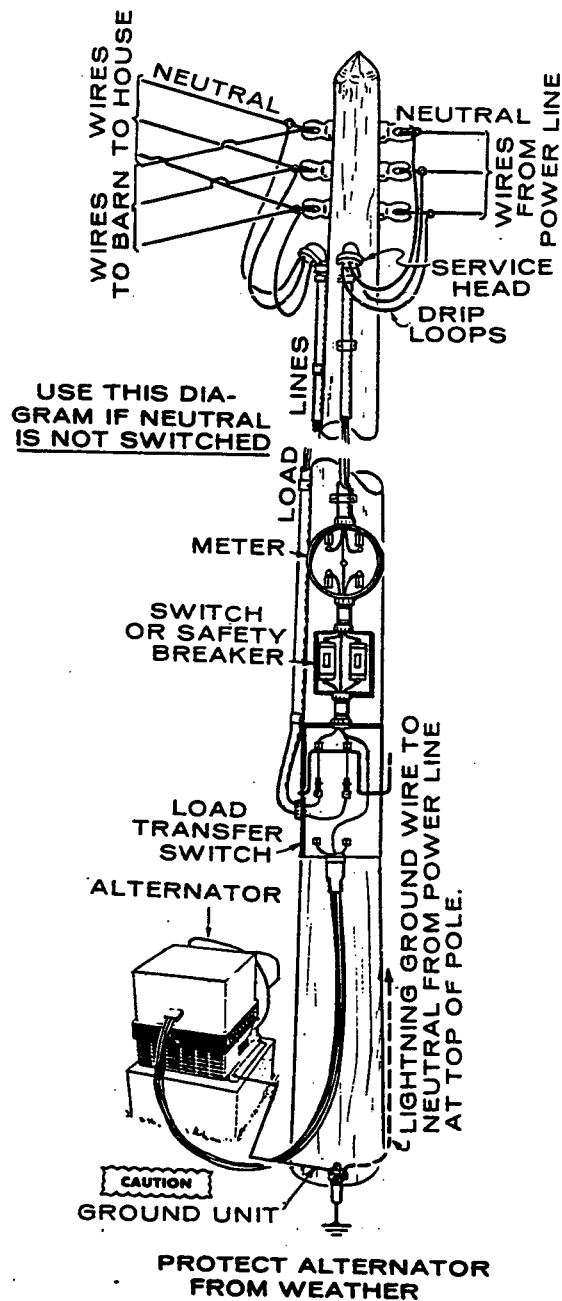
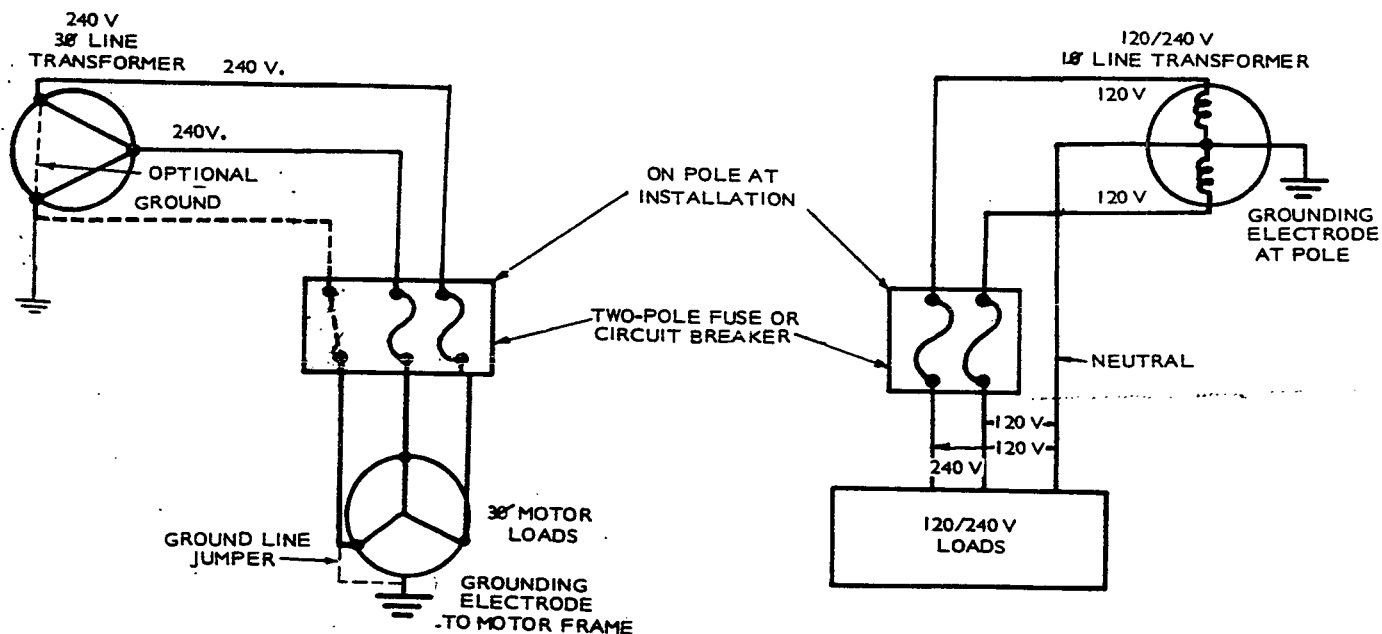
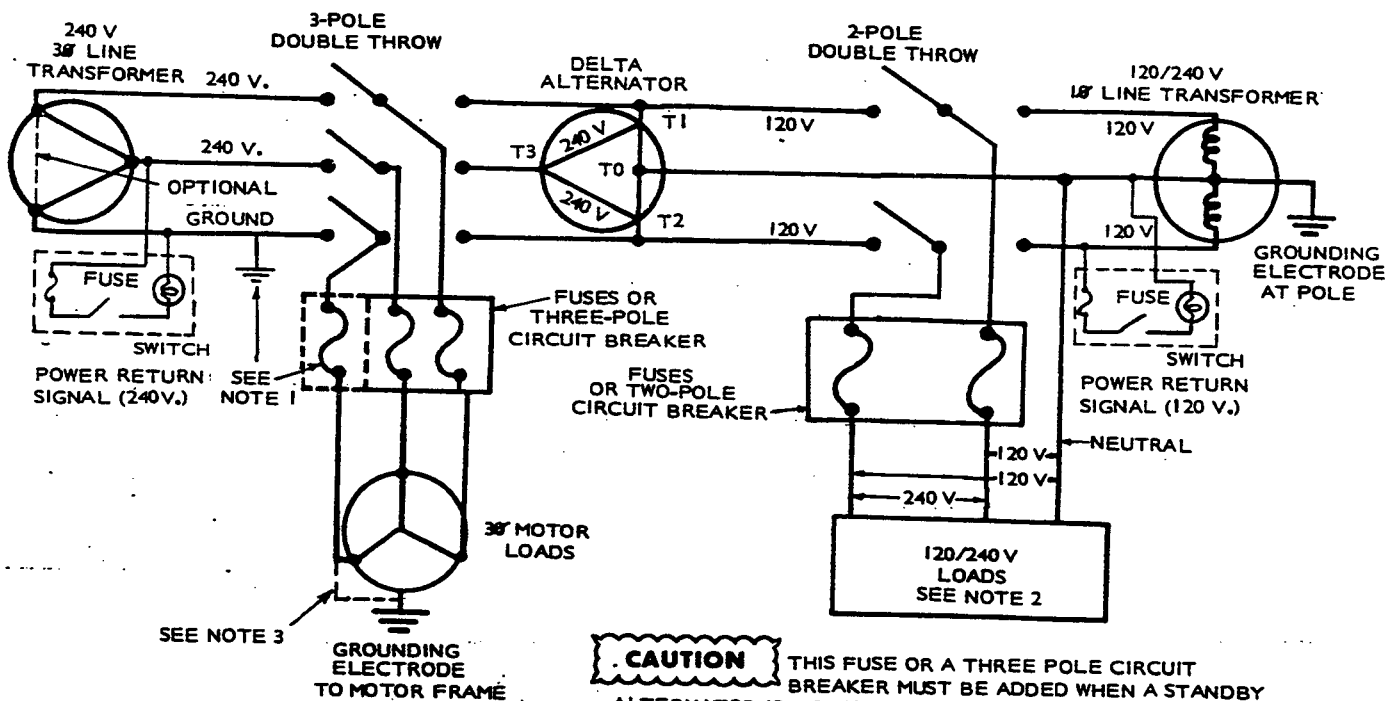


FIGURE 8. TYPICAL FARM STANDBY, SINGLE PHASE



TYPICAL CIRCUITS BEFORE INSTALLING ONAN PTO ALTERNATOR



CAUTION

THIS FUSE OR A THREE POLE CIRCUIT BREAKER MUST BE ADDED WHEN A STANDBY ALTERNATOR IS INSTALLED TO SUPPLY POWER. THE GROUNDING ELECTRODE MUST THEN BE MOVED TO THE UTILITY SIDE OF THE FUSE OR CIRCUIT BREAKER.

WARNING

CHECK ALL LOADS FOR GROUNDS WITH AN OHMMETER BEFORE CONNECTING ALTERNATOR TO LOAD TO BE SURE THE MOTORS ARE ELECTRICALLY SAFE FROM SHOCKS DUE TO INSULATION FAILURES.

WARNING

REMOVE ALL GROUNDLINE JUMPERS, BUT GROUND THE FRAME OF ALL MOTORS TO EARTH TO BE SURE PERSONNEL ARE SAFE FROM ELECTRICAL SHOCKS DUE TO INSULATION FAILURES.

TYPICAL CIRCUIT AFTER INSTALLING PTO ALTERNATOR

FIGURE 9. COMBINATION SINGLE AND THREE PHASE LOAD TRANSFER

INSTALLATION OF LOAD CABLE PLUG KITS

The YD PTO Alternators are factory equipped with either a single phase or a three phase output receptacle. The alternator single phase load cable connector will only accept the single phase cable assembly plug. The alternator three phase load cable connector will accept either the single or the three phase cable assembly plugs to provide either single or three phase power from a three phase alternator. The matching cable connectors supplied in Connector Housing Accessory Kit for single phase and three phase units require assembly to the customer's cable unless a complete cable is ordered with the alternator.

GENERAL

Field assembly of the cable connectors supplied in the above kits requires a heavy duty crimping tool or a high heat soldering iron. A torch is not recommended for soldering by inexperienced personnel for two reasons. First, the flame heat will burn the insulation from the cable; second, an excessive amount of solder may accumulate on the outside of the terminal preventing proper insertion of the terminal into the plug.

ASSEMBLY

1. Remove one inch of insulation from end of each cable for proper metal-to-metal contact with terminal end.
2. If a heavy duty crimping tool is available, insert wire end fully into terminal as shown in Figure 10 for No. 2 and No. 4 wire. Then crimp terminal onto wire to make a good electrical connection. Crimp each terminal and wire end in the same way.

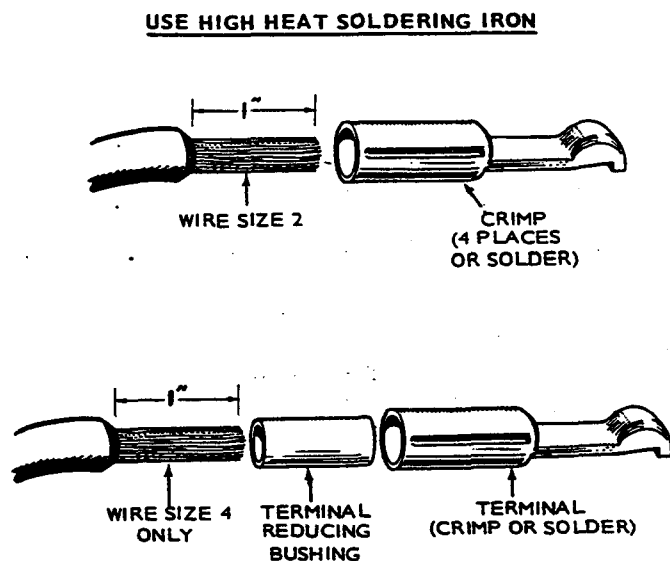


FIGURE 10. CABLE WIRE TO TERMINAL CONNECTIONS

WARNING

Use care with soldering iron and heated material to avoid being burned.

3. If a high heat soldering iron is used, proceed as follows:
 - a. Insert wire end fully into terminal as shown in Figure 10 for No. 2 and No. 4 wire. Use reducing sleeve with No. 4 wire. Hold wire and terminal horizontal while soldering, if possible.
 - b. Apply heat from soldering iron at center of terminal sleeve until heat draws solder into terminal around wire.
 - c. Add only enough solder to fill space in and around wire to make a good electrical connection.
 - d. Using a clean rag, wipe excess solder accumulation, if any, from outside of terminal for a smooth finish. Otherwise the terminal may not fit into the connector housing. Solder each terminal and wire in the same way.
4. Assemble cable terminal ends into plug housing assembly as indicated in Figure 11. The terminal just snaps into the plug and is retained by a flat spring.

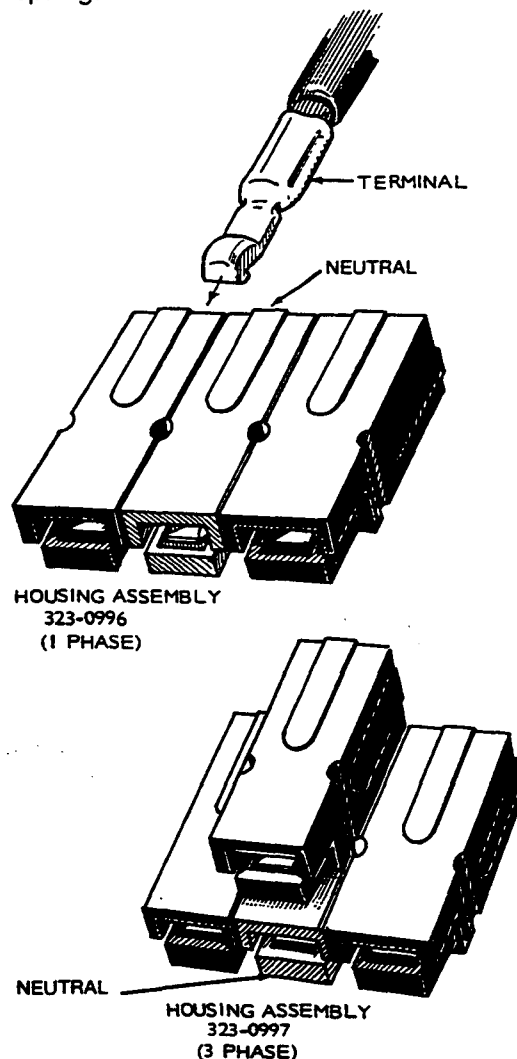


FIGURE 11. SINGLE AND THREE PHASE PLUGS

Each terminal can be removed from the plug by using a thin blade to release the terminal while a slight pull is made on the cable, Figure 12.

5. The cable and plug are now ready for mating with the receptacle on the alternator as soon as the other end of the cable is attached to the power pole transfer switch. See Figure 12.

CAUTION

Be sure the neutral cable connects to the white plug at the center of the housing for proper mating to the white receptacle on the PTO alternator. Any cross-connection between the neutral lead and one hot lead at the connection could cause equipment damage in the load circuits and trip the load circuit breakers on the alternator control panel.

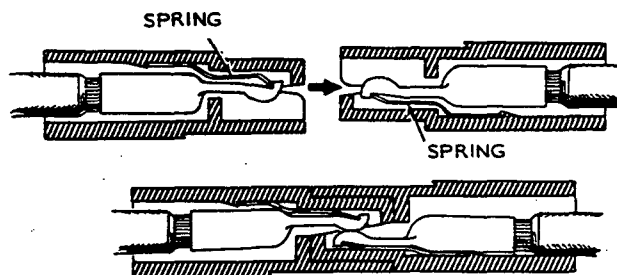


FIGURE 12. CONNECTOR HOUSING AND TERMINAL CONNECTION DETAILS

WARNING

ENGINE EXHAUST GAS (CARBON MONOXIDE) IS DEADLY!

Carbon monoxide is an odorless, colorless gas formed by incomplete combustion of hydrocarbon fuels. Carbon monoxide is a dangerous gas that can cause unconsciousness and is potentially lethal. Some of the symptoms or signs of carbon monoxide inhalation are:

- Dizziness
- Intense Headache
- Weakness and Sleepiness
- Vomiting
- Muscular Twitching
- Throbbing in Temples

If you experience any of the above symptoms, get out into fresh air immediately.

The best protection against carbon monoxide inhalation is a regular inspection of the complete exhaust system. If you notice a change in the sound or appearance of exhaust system, shut the unit down immediately and have it inspected and repaired at once by a competent mechanic.

OPERATION

STANDBY OPERATION

When a power outage occurs, the alternator should be ready to run and to take over the electrical load, Figure 13.

1. Set up tractor and install PTO shaft. Depress spring loaded pin on PTO shaft at alternator end of drive shaft. Slide yoke onto alternator PTO shaft making sure spring loaded pin falls onto groove on alternator splined shaft.

WARNING Be sure all power shields and guards are in place and secured before starting unit to prevent possible injuries to personnel.

2. Position alternator circuit breaker to OFF.
3. If alternator is mounted on a trailer for portable use, connect power leads between receptacles or alternator and load.
4. Throw transfer switch to disconnect commercial power and connect load to alternator, Figures 8 and 9.
5. Turn power return signal ON, if one has been installed.

WARNING

To avoid injury to the operator, be sure tractor range shift lever is in the park position and/or the brakes are locked before dismounting the tractor or operating the alternator.

6. Start tractor, engage power take-off, and bring PTO shaft speed up to 540-600 rpm.
7. With alternator running, position alternator circuit breaker to ON position. At 600 rpm (PTO) the voltmeter on the alternator control box reads about 250 volts (in the green range on voltmeter).
8. Various electrical loads can now be connected.

When two or more single phase circuits are available, do not overload any one circuit—divide the load equally among them.

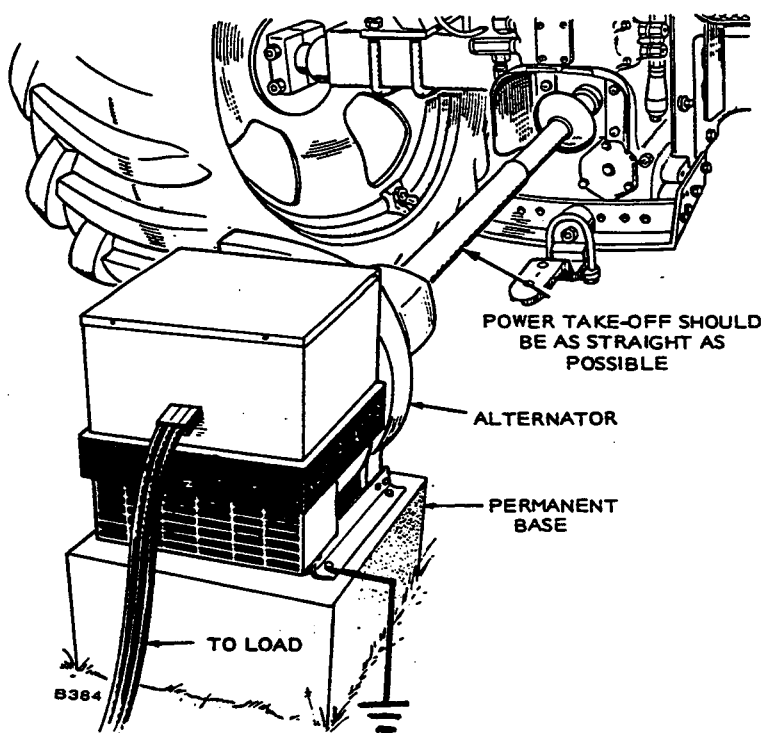


FIGURE 13. TRACTOR CONNECTION

APPLYING LOAD TO ALTERNATOR

When connecting motor loads, connect one motor at a time allowing each motor to reach running speed before connecting the next one. Motors require much more current for starting than for running at normal speed. If several motors are started at the same time, the total electrical load may overload the alternator, tripping the circuit breaker. Remove the load before throwing the circuit breaker back to the ON position.

Keep the alternator load within its nameplate rating. If the alternator is seriously overloaded, the circuit breaker will automatically trip, disconnecting the entire electrical load. Reduce the load before throwing the circuit breaker to the ON position.

If the tractor engine has very little reserve power, it may be necessary to change the engine throttle if large changes occur in the electrical system.

CAUTION Consult specification sheet on page 2 and ensure that the tractor horsepower capability will meet the alternator output capacity. If the tractor has little reserve power the governor may not act quickly enough when the electrical load is removed. This could cause a surge of speed and high voltage which may damage any electrical equipment left connected.

When disconnecting large portions of the load, disconnect one piece of equipment at a time, or first disconnect that part of the load which will be left on. Then remove the rest of the load. Wait until voltage has stabilized, then reconnect the portion of the load which will be left on. The alternator voltage will remain stabilized and the tractor engine speed will not change or surge enough to cause any damage if this procedure is followed.

LOAD REQUIREMENTS

Add up all of the wattage requirements of all electrical equipment that could be operating simultaneously during a power outage. Take the information either from typical wattage requirements (Table 1) or from the nameplate on the equipment itself. Compare the total load requirements with the output rating of the alternator to determine how motor starting and total load will affect the alternator.

Check the motor nameplates for the horsepower rating of essential equipment: oil burner pump, furnace blower motor, circulating heater, electric milking machine, milk pump, barn cleaner, feed conveyor, silage unloader, chick brooder, sump pump, well pump, poultry house ventilating fan, freezer, refrigerator, washing machine, etc.

Start motors one at a time, beginning with the largest one. Then, after all motors are running, there will be extra power for other less critical equipment such as a television.

ALTERNATOR SPEED

Low input speed to the alternator causes low voltage and frequency. For example: if an 1800 rpm alternator is slowed to 1500 rpm, the frequency of the current produced will be 50 hertz instead of 60 hertz.

CAUTION The low voltage and low frequency combination could result in burned output windings in any motor connected to the alternator such as refrigerators, silo unloader, feeder, etc. Undervoltage will not damage fans, blowers, or pump motors, but will cause a TV set picture to roll or have a smaller picture than normal.

TABLE 1.
TYPICAL WATTAGE REQUIREMENTS

MOTORS* (Capacitor Type)	WATTS REQUIRED	
	START	RUN
1/2 horsepower	2800	550
3/4 horsepower	4300	775
1 horsepower	5500	1000
2 horsepower	7130	1960
3 horsepower	10350	2970
5 horsepower	16660	3500
7-1/2 horsepower	23000	5250

* - Repulsion-induction motors require less starting wattage. Split phase motors require slightly more starting wattage.

POWER REQUIREMENTS

Item	Approx. Wattage
Refrigerator	600-1000
Dishwasher	1000-1800
Water Heater	1500-5000
Space Heater	1000-1500
Television	200-600
Electric Drill	250-750
Water Pump	450-1000
Range Top (per element)	3000-4000
Food Freezer	300-800
Brooders	500-1000
Stock Tank Heater	300-1400

SERVICE AND MAINTENANCE

PERIODIC SERVICE AND INSPECTION

Follow a regular schedule of inspection and servicing. Make a good visual check before, while, and after alternator is operating; look for loose or broken leads and bad connections.

GEAR BOX LUBRICATION

Use only SAE 90 EP multi-purpose gear lubricant. Drain the gear box after the first 100 hours of operation and refill with fresh lubricant of the recommended grade. Repeat this procedure each year thereafter, or every 250 hours. Maintain the proper oil level between changes.

CAUTION

Overfilling will cause foaming, which can lead to an oil leak.

Remove oil fill plug at top of the case and oil level plug from the face of the gear case, Figure 14. Fill case until oil flows from the oil level plug hole. Gear box holds 1 pint (0.47 litre) U.S. measure. Replace both plugs.

PTO SHAFT LUBRICATION

Grease the universal joints and telescoping shafts on the PTO shaft at least every 25 operating hours. Under adverse conditions, grease the joints as required, possibly every 4 to 8 hours.

WARNING

For personnel safety, never operate the alternator with the protective guards removed from the PTO shaft.

BEARINGS

The ball-bearings in the gear box are lubricated by the gear box lubricant (SAE 90 EP).

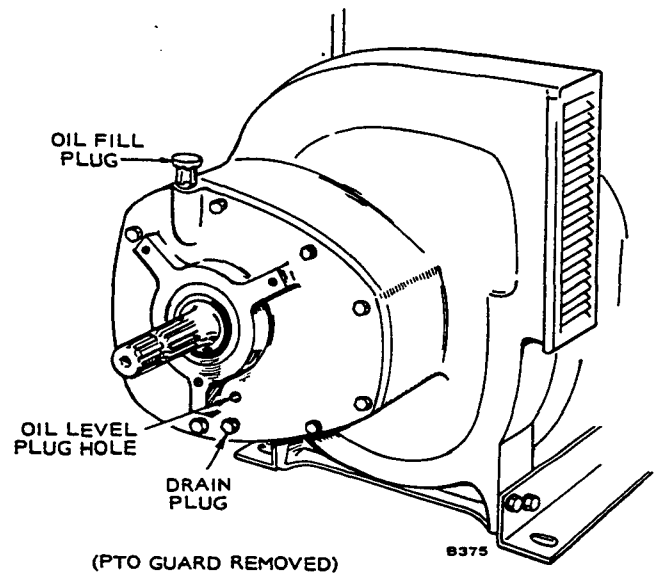


FIGURE 14. GEAR BOX LUBRICATION

TROUBLESHOOTING

A few simple checks and a proper troubleshooting procedure can locate the probable source of trouble and cut down troubleshooting time.

1. Check all modifications, repairs, and replacements performed since last satisfactory operation of unit to be sure that connection of generator leads are correct. A loose wire connection, overlooked when installing a replacement part could cause problems. An incorrect connection, an opened circuit breaker, or a loose printed circuit board are all potential malfunction areas to be eliminated by a visual check.
2. Unless absolutely sure that panel instruments are accurate, use portable test meters for troubleshooting.
3. Visually inspect components on voltage regulator. Look for dirt, dust, moisture and cracks in the printed solder conductors. Burned resistors, arcing tracks are all identifiable. Do not mark on printed circuit boards with a pencil. Graphite lines are conductive and can cause short circuits between components.

TROUBLESHOOTING

NATURE OF TROUBLE	POSSIBLE CAUSE	REMEDY
Alternator Overheats	1. Windings and parts covered with dirt and oil.	1. Disassemble alternator and clean.
	2. Air intake is restricted or incoming air too hot.	2. Clean alternator air intake and outlet areas.
	3. Overloaded.	3. Remove part of load.
Noisy Alternator	1. Alternator loose on base.	1. Tighten mounting bolts.
	2. Defective bearing.	2. Replace. Check alignment.
No Voltage Output	1. Voltage regulator trouble, or open, short or grounded circuit in alternator.	1. Call your Equipment Service Center.
	2. Alternator leads broken or loose.	2. Tighten connections and replace broken leads.
	3. Load circuit breaker in tripped position.	3. Remove part of load and reset circuit breaker.
	4. Open circuit of field or stator winding.	4. Make proper connections.
	5. Short circuit of winding in the field or stator.	5. Call your Equipment Service Center.
Low Voltage Output of Alternator	1. External short circuit on line.	1. Test alternator with line wires disconnected.
	2. Incorrect PTO speed.	2. Readjust PTO speed to 540 to 600 rpm.

PARTS CATALOG

929-0002 (10-79)
YD PARTS CATALOG

INDEX

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This catalog applies to the standard YD Alternators listed below. Parts are arranged in groups of related items. Each illustrated part is identified by a reference number corresponding to the same reference number in the parts list for that group. Parts illustrations are typical. Using the *Model* and *Spec No.* from the nameplate, select the *Parts Key No.* 1,2, etc., in the last column) that applies to your set *Model* and *Spec No.* This *Parts Key No.* represents parts that differ between models. Unless otherwise mentioned in the description, parts are interchangeable between models. Right and left sides are determined by facing the PTO shaft end (front) of the set.

ALTERNATOR DATA TABLE

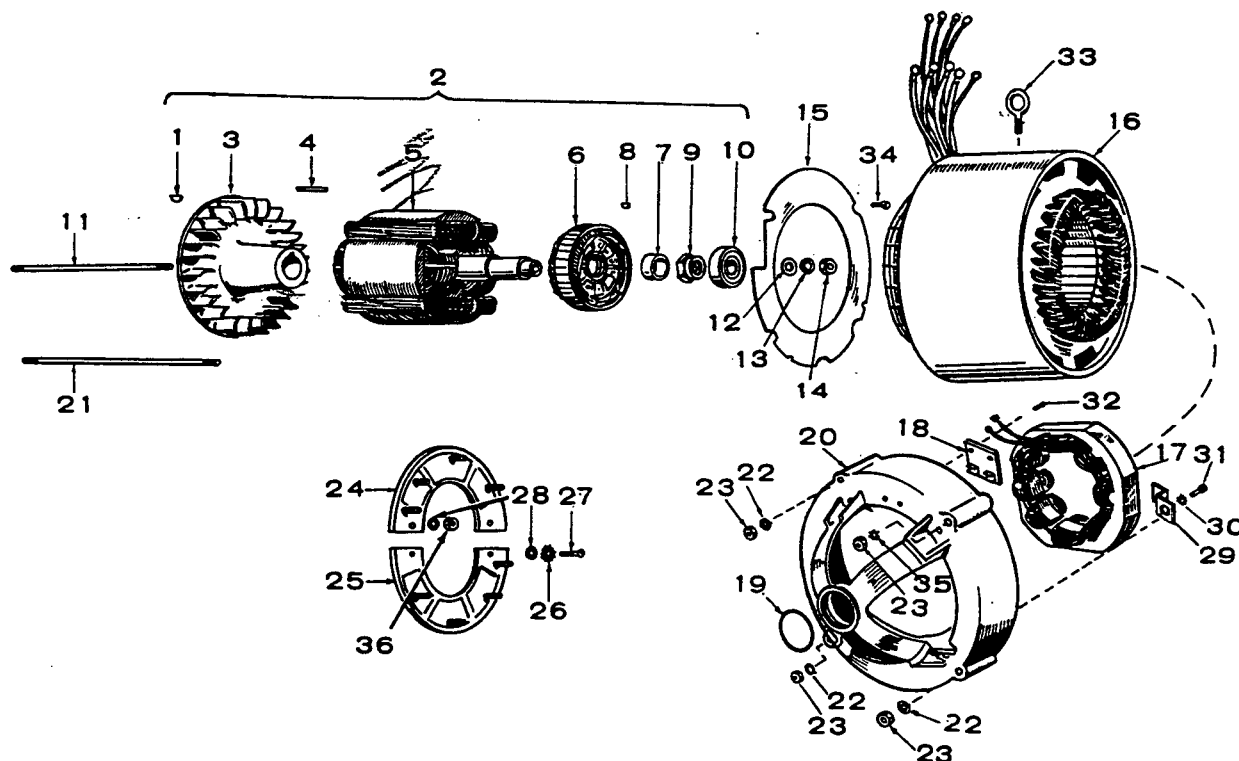
MODEL & SPEC NO.	ELECTRICAL DATA					PARTS KEY NO.
	WATTS	VOLTS	HERTZ	WIRE	PHASE	
15.0YD-3G/*	15,000	120/240	60	3	1	1
20.0YD-3G/*	20,000	120/240	60	3	1	2
20.0YD-5DG/*	20,000	120/240	60	4	3	3
25.0YD-3G/*	25,000	120/240	60	3	1	4
25.0YD-5DG/*	25,000	120/240	60	4	3	5
30.0YD-3G/*	30,000	120/240	60	3	1	6
30.0YD-5DG/*	30,000	120/240	60	4	3	7

* - The specification letter advances (A to B, B to C, etc.,) with manufacturing changes.

NOTICE!

ITEMS REFERENCED AS **OPTIONAL** INDICATE PART IS FACTORY INSTALLED AND MAY NOT BE APPLICABLE TO ALL MODELS. FOR FIELD CONVERSIONS ADDITIONAL PARTS ARE USUALLY REQUIRED.

ALTERNATOR

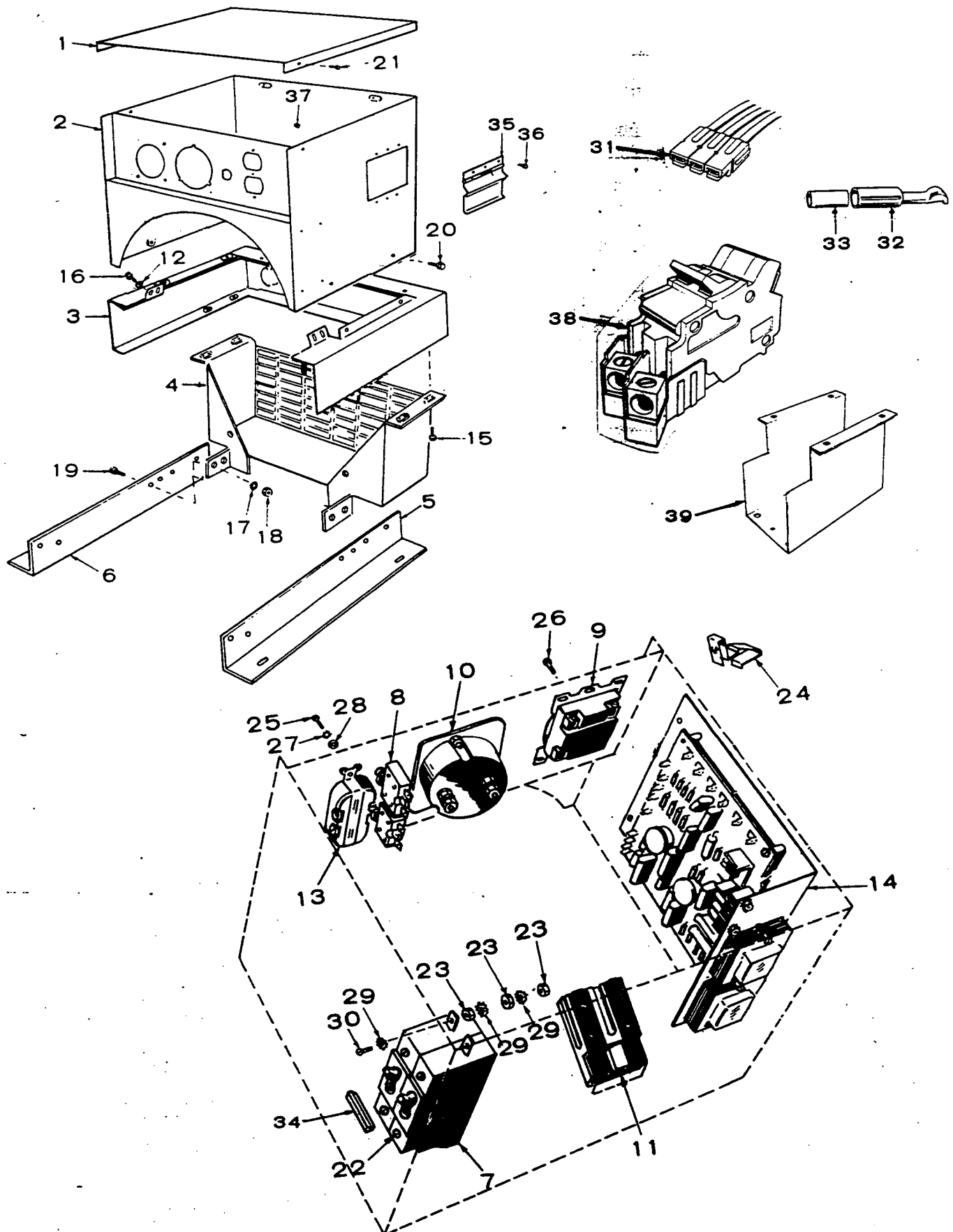


REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	515-0124	1	Key, Alternator to Gearbox Shaft
2	ROTOR ASSEMBLY (Includes parts marked *)		
	201-2157	1	Key 1
	201-2159	1	Keys 2,3
	201-2160	1	Keys 4,5
	201-2446	1	Keys 6,7
3	205-0105	1	*Fan, Generator
4	515-0103	1	*Key, Blower Fan
5	ROTOR, WOUND		
	201-2052	1	Key 1
	201-2054	1	Keys 2,3
	201-2055	1	Keys 4,5
	201-2439	1	Keys 6,7
6	*ROTOR ASSEMBLY, WOUND - EXCITER (Includes parts marked #)		
	201-2151	1	Keys 1,2,3,4,5
	201-2152	1	Keys 6,7
7	232-2398	1	*Spacer, Bearing
8	515-0094	1	*Key, Exciter Rotor
9	870-0284	1	*Nut, Lock (Nylon Insert)
10	510-0112	1	*Bearing, Rotor
11	STUD, ROTOR THROUGH		
	520-0789	1	Key 1
	520-0791	1	Keys 2,3
	520-0792	1	Keys 4,5
	520-0858	1	Keys 6,7
12	232-0200	1	Washer, Cone Shaped
13	850-0055	1	Washer, Lock - Spring (7/16")
14	870-0203	1	Nut, Hex (7/16-20)
15	234-0519	1	Baffle, Air
16	STATOR ASSEMBLY, WOUND		
	220-2354	1	Key 1
	220-2740	1	Key 2
	220-2989	1	Key 3
	220-2355	1	Key 4
	220-2356	1	Key 5
	220-2595	1	Key 6
	220-2602	1	Key 7

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
17	STATOR, WOUND - EXCITER		
	220-2009	1	Keys 1,2,3,4,5
	220-2010	1	Keys 6,7
18	232-2418	1	Board, Connection
19	509-0094	1	Seal, "O" Ring
20	211-0256	1	Bell, End
21	STUD, ALTERNATOR, THROUGH		
	520-0797	4	Key 1
	520-0799	4	Keys 2,3
	520-0800	4	Keys 4,5
	520-0801	4	Keys 6,7
22	850-0050	3	Washer, Lock - Spring (3/8")
23	862-0011	4	Nut, Hex (3/8-16)
24	358-0069	1	#Diode and Heat Sink (Positive)
25	358-0070	1	#Diode and Heat Sink (Negative)
26	853-0008	4	#Washer, Lock - ET (#10)
27	813-0100	4	#Screw, Machine - Round Head (#10-32 x 1/2")
28	526-0008	10	#Washer, Flat (13/64" ID x x 7/16" OD x 1/32")
29	232-2584	2	Retainer, Stator - Keys 6,7
30	853-0013	2	Washer, Lock - ET (1/4")
31	800-0004	2	Screw, Cap - Hex Head (1/4-20 x 5/8")
32	815-0194	2	Screw, Cap - Hex Head W/ET (#10-32 x 3/16")
33	403-0095	1	Bolt, Eye - Lifting
34	821-0008	4	Screw, Cap - Hex Head (1/4-20 x 5/16")
35	856-0010	2	Washer, Lock - EIT (3/8")
36	870-0131	8	#Nut, Hex with ET (#10-32)

* - Parts included in complete Rotor Assembly.
- Parts included in Exciter Rotor Assembly.

CONTROL AND MOUNTING FEET

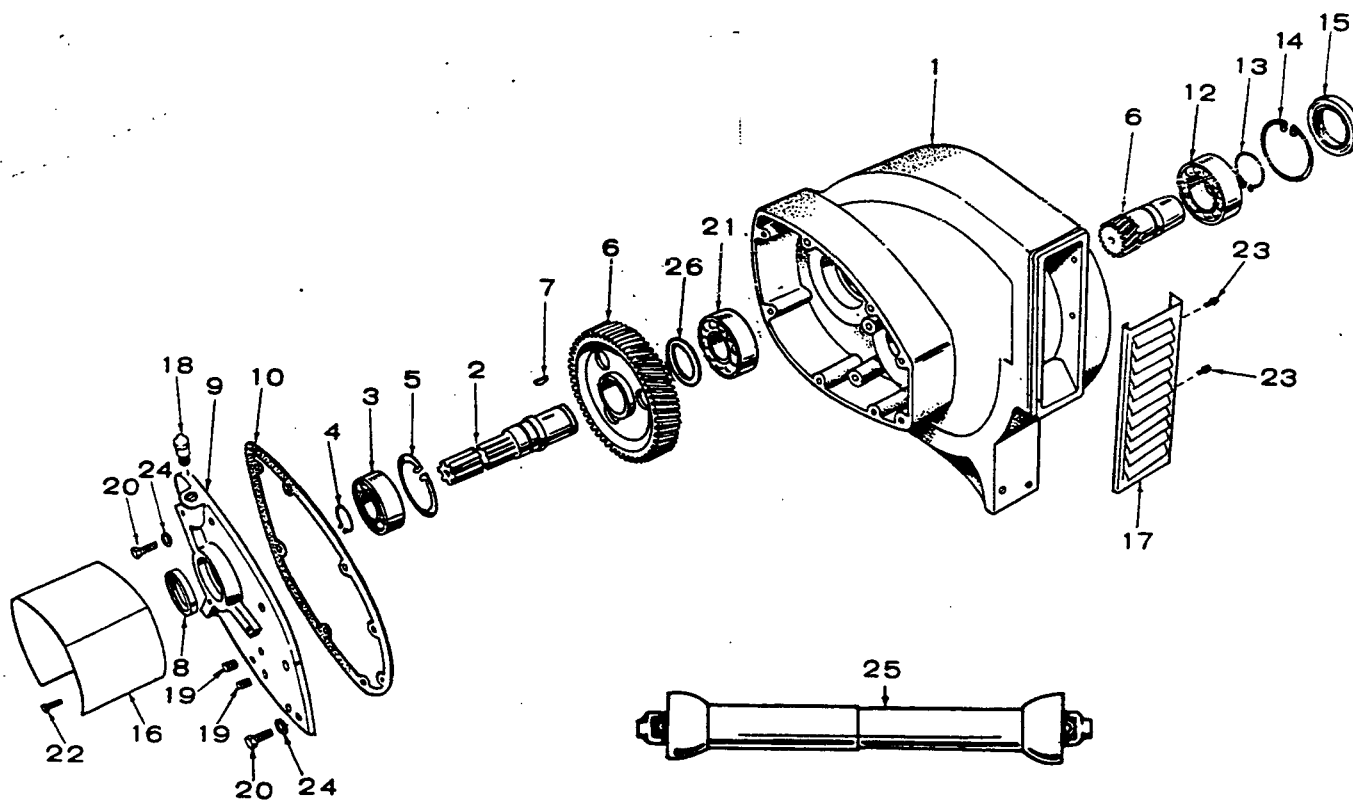


CONTROL AND MOUNTING FEET

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	301-3775	1	Cover, Control Box
2	BOX, CONTROL		
	301-3913	1	Keys 1,2,4
	301-3914	1	Keys 3,5,7
	301-4518	1	Key 6
3	301-3698	1	Support, Control Box
4	234-0523	1	Grille, Air Inlet
5	FOOT, MOUNTING (Right Side)		
	232-2454	1	Keys 1,4,5
	232-2655	1	Keys 2,3
	232-2626	1	Keys 6,7
6	FOOT, MOUNTING (Left Side)		
	232-2455	1	Keys 1,4,5
	232-2656	1	Keys 2,3
	232-2625	1	Keys 6,7
	320-0642	1	Key 7 (90 Ampere)
7	BREAKER, CIRCUIT		
	320-0629	1	Key 1 (65 Ampere)
	320-0633	1	Key 2 (85 Ampere)
	320-0640	1	Key 3 (60 Ampere)
	320-0632	1	Key 4 (100 Ampere)
	320-0641	1	Key 5 (75 Ampere)
8	BREAKER, CIRCUIT		
	320-0505	1	3 Ampere
	320-0540	1	15 Ampere
	320-0548	2	50 Ampere
9	323-0894	1	Receptacle, Output
10	302-0551	1	Voltmeter (0-300 Volts)
11	HOUSING, CONNECTOR		
	323-0996	2	Keys 1,2,4,6
	323-0997	2	Keys 3,5,7
12	856-1008	4	Washer, Lock - EIT (5/16")
13	323-0383	1	Receptacle, Duplex
14	REGULATOR ASSEMBLY, VOLTAGE		
	(See separate group for components)		
	305-0534	1	Keys 1,2,3,4,5
	305-0579	1	Keys 6,7
15	821-0010	4	Screw, Cap - Hex Head Locking (1/4-20 x 1/2")
16	815-0236	4	Screw, Cap - Hex Head Locking (5/16-18 x 5/8")
17	850-0055	8	Washer, Lock - Spring (7/16")
18	862-0004	4	Nut, Hex (7/16-14)
19	800-0071	8	Screw, Cap - Hex Head (7/16-14 x 1")

REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
20	821-0010	4	Screw, Cap - Hex Head Locking (1/4-20 x 1/2")
21	821-0005	4	Screw, Cap - Hex Head Locking (#10-32 x 1/2")
22	SCREW, MACHINE - ROUND HEAD		
	812-0059	4	Keys 1,2,4,6 (#6-32 x 1/4")
	812-0059	6	Keys 3,5,7 (#6-32 x 1/4")
23	NUT, HEX - BRASS (#10-32)		
	871-0010	12	Key 1,2,4
	871-0010	18	Keys 3,5,7
24	518-0343	2	Clip, Regulator Assembly Mounting
25	812-0079	2	Screw, Machine - Round Head (#8-32 x 1/2")
26	812-0059	4	Screw, Machine - Round Head (#6-32 x 1/4")
27	853-0005	2	Washer, Lock - ET (#8)
28	860-0008	2	Nut, Hex (#8-32)
29	WASHER, LOCK - ET (#10)		
	853-0008	4	Keys 1,2,4
	853-0008	6	Keys 3,5,7
30	SCREW, MACHINE - ROUND HEAD - BRASS (#10-32 x 3/4")		
	811-0103	4	Keys 1,2,4
	811-0103	6	Keys 3,5,7
31	HARNES, WIRING		
	338-0980	1	Keys 1,2,4,6
	338-0981	1	Keys 3,5,7
32	TERMINAL, CONNECTOR		
	332-1880	6	Keys 1,2,4,6
	332-1880	8	Keys 3,5,7
33	BUSHING, TERMINAL REDUCER		
	332-1881	6	Keys 1,2,4,6
	332-1881	8	Keys 3,5,7
34	LOCK, CIRCUIT BREAKER HANDLE (PRIOR TO SERIAL NUMBER 770252190 DURING SPEC AA)		
	320-0202	1	Keys 1,4
	320-0187	1	Key 5
35	301-4233	1	Cover, Load Plug
36	821-0004	2	Screw, Cap - Hex Head Locking (#10-32 x 5/16")
37	870-0320	2	Nut, Hex - Locking (#10-32)
38	320-0580	1	Breaker, Circuit (125 Ampere) Key 6
39	301-3985	1	Bracket, Circuit Breaker Mounting - Key 6

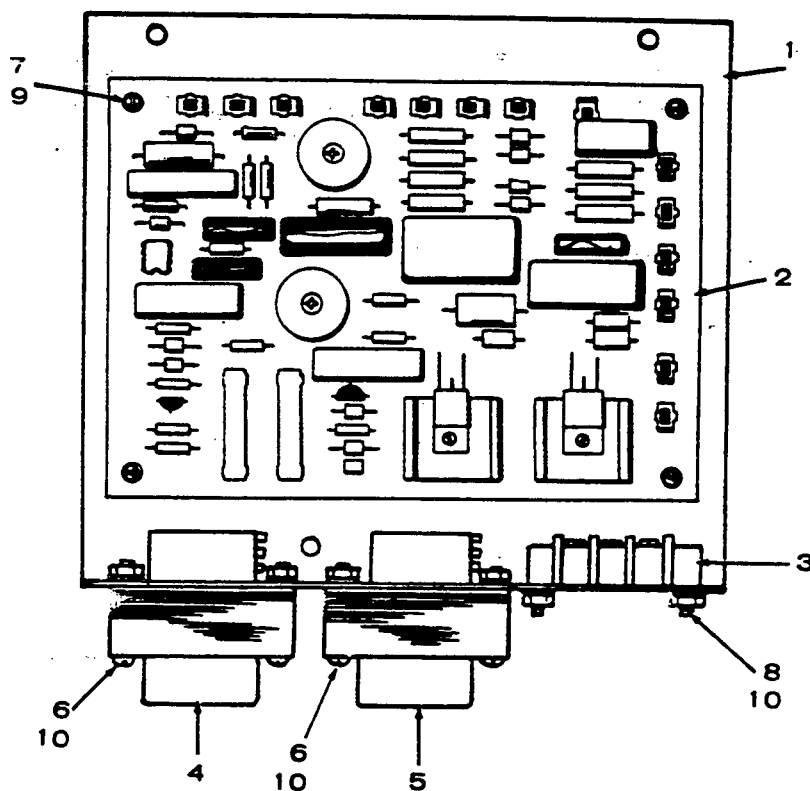
GEARBOX



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
1	231-0184	1	Adapter and Gear Drive Case
2	190-0409	1	Shaft, Input Gear
3	510-0114	1	Bearing, Ball - Input Shaft
4	518-0122	1	Ring, Retaining - External
5	518-0287	1	Ring, Retaining - Internal
6	190-0437	1	Gear Set
7	515-0141	1	Key, Gear to Shaft
8	509-0138	1	Seal, Oil
9	190-0408	1	Plate, Bearing
10	103-0451	1	Gasket, Bearing Plate
12	BEARING, BALL		
	510-0113	1	Keys 1,2,3,4,5
	510-0126	1	Keys 6,7
13	518-0333	1	Ring, Retaining - External
14	518-0334	1	Ring, Retaining - Internal
15	509-0139	1	Seal, Oil
16	190-0384	1	Guard, Power Take-Off
17	234-0581	1	Grille, Air Outlet

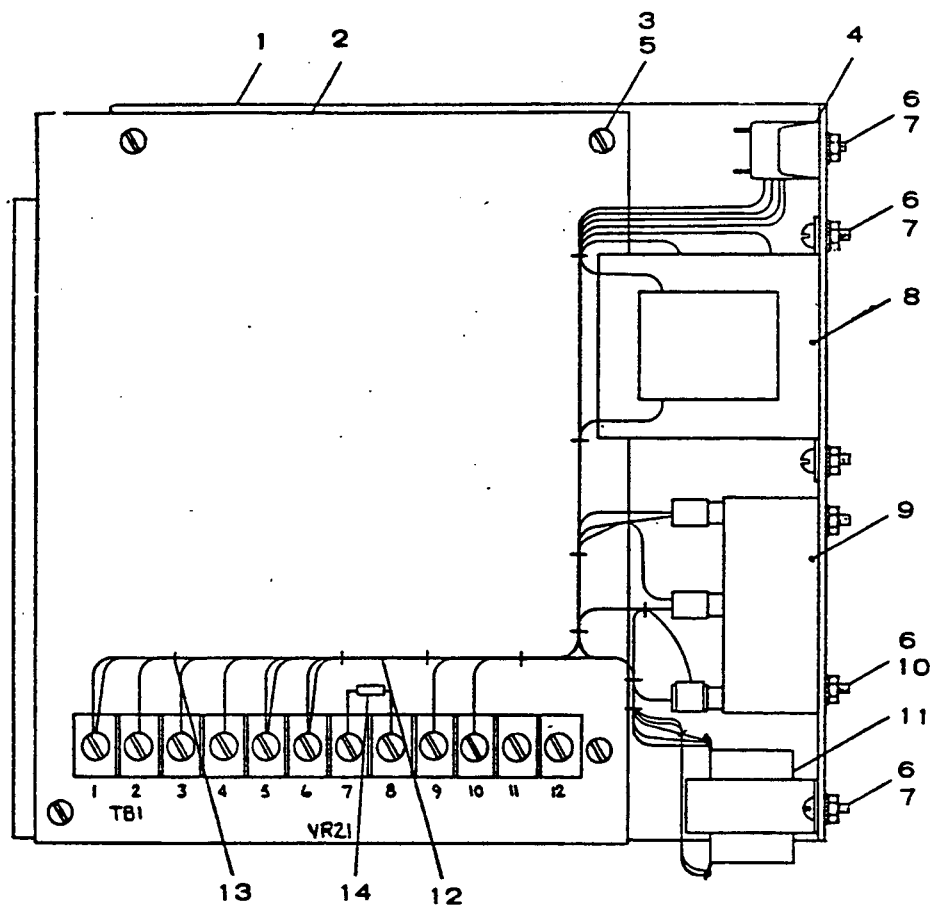
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
18	518-0275	1	Vent and Fill Plug
19	502-0028	2	Plug, Drain and Level
20	800-0029	8	Screw, Cap - Hex Head (5/16-18 x 1-1/8")
21	510-0117	1	Bearing, Ball
22	821-0014	3	Screw, Cap - Hex Head Locking (5/16-18 x 1/2")
23	821-0008	2	Screw, Cap - Hex Head Locking (1/4-20 x 5/16")
23	808-0032	2	Screw, Socket Head (1/4-20 x 1/4") Keys 1,2,3,4,5
24	850-0045	8	Washer, Lock - Spring (5/16")
25	ROD, TUMBLING - OPTIONAL		
	190-0467	1	Key 1
	190-0446	1	Keys 2,3,4,5,6,7
26	526-0269	1	Washer, Flat (1.78 ID x 2.25 OD x .125" Thk)

VOLTAGE REGULATOR (Keys 1,2,3,4,5)



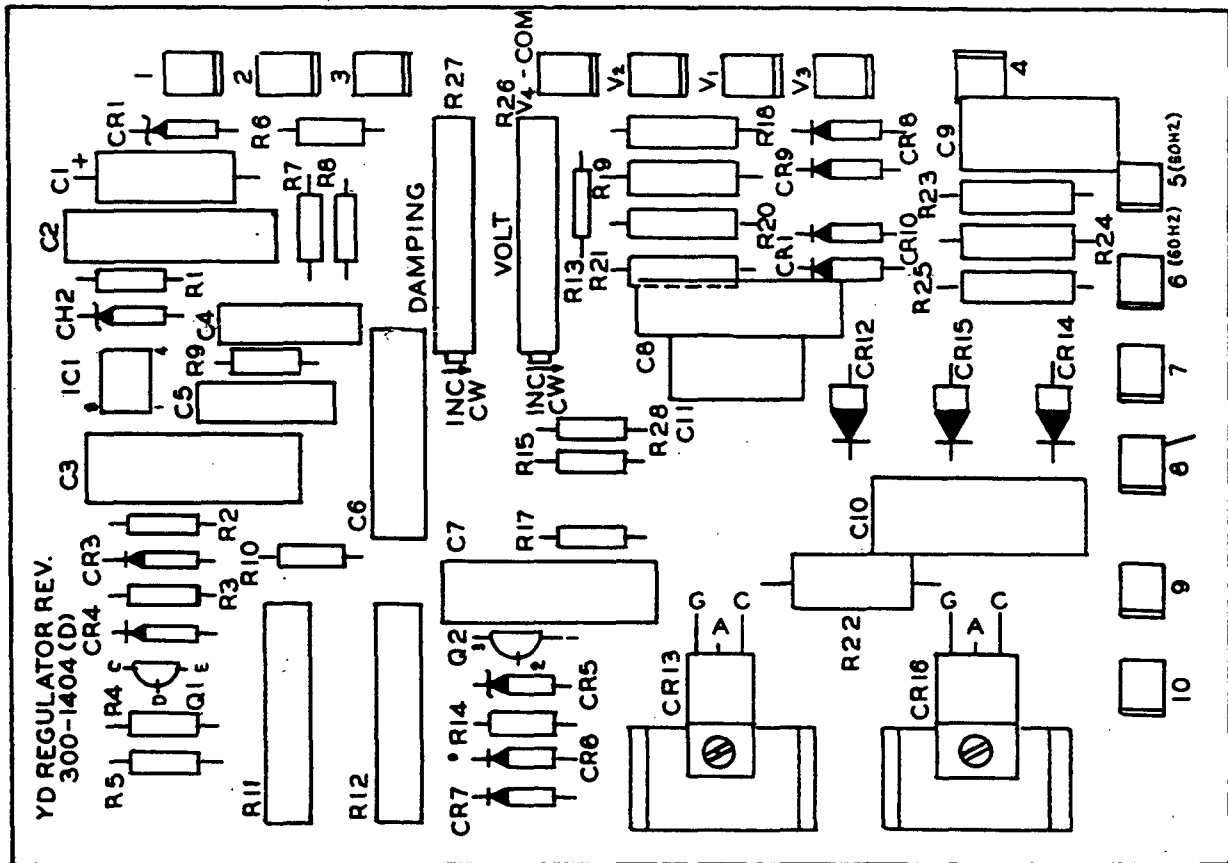
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	305-0534	1	Regulator Assembly, Voltage (Complete)
1	301-3719	1	Panel, Voltage Regulator Mounting
2	300-1404	1	Board Assembly, Regulator - (See Separate Group for Components)
3	332-1655	1	Strip, Terminal
4	315-0386	1	Transformer, Voltage
5	315-0391	1	Reactor
6	812-0070	4	Screw, Machine - Round Head (#6-32 x 1-1/4")
7	812-0061	4	Screw, Machine - Round Head (#6-32 x 3/8")
8	812-0063	2	Terminal Strip Mounting (#6-32 x 1/2")
9	853-0003	4	Washer, Lock - ET (#6)
10	870-0183	8	Nut, Hex - With ET (#6-32)

VOLTAGE REGULATOR (Keys 6,7)



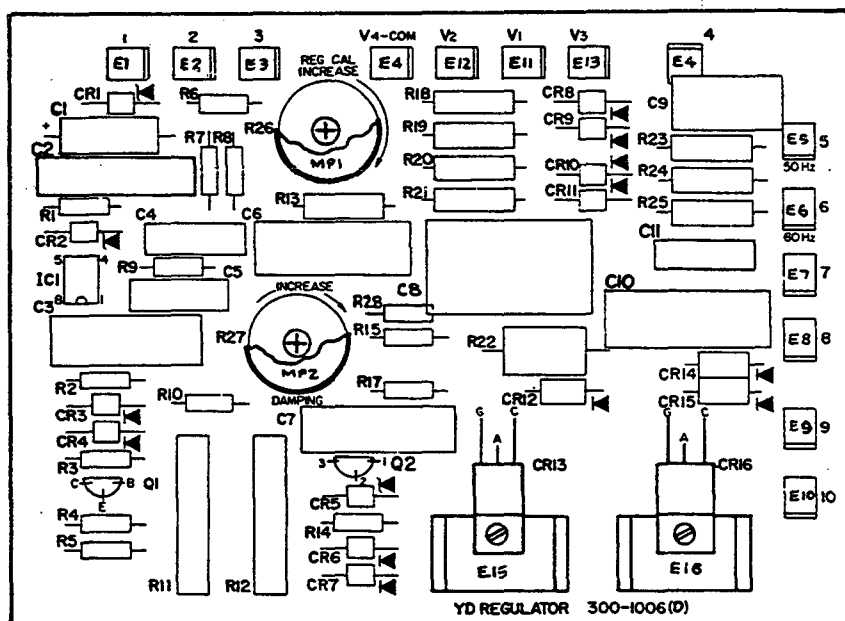
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	305-0579	1	Regulator Assembly, Voltage (Complete)
1	301-4591	1	Panel, Voltage Regulator Mtg.
2	332-1956	1	Board Assembly, Regulator (See Separate Group for Components)
3	812-0059	4	Screw, Machine - Round Head (#6-32 x 1/4")
4	332-2097	1	Block, Terminal
5	853-0003	4	Washer, Lock ET (#6)
6	870-0183	8	Nut, Hex - W/ET (#6-32)
7	812-0061	6	Screw, Machine - Round Head (#6-32 x 3/8")
8	315-0431	1	Transformer, Volt
9	305-0524	1	Bridge, SCR
10	812-0070	2	Screw, Machine - Round Head (#6-32 x 1-1/4")
11	315-0343	1	Reactor
12	338-1124	1	Harness, Wiring
13	332-0942	10	Tie, Cable
14	350-1190	1	Resistor (1740-Ohm, 1/4 Watt)

**VOLTAGE REGULATOR BOARD (Keys 1,2,3,4,5
Begin Serial Number E760133373 During Spec AA)**



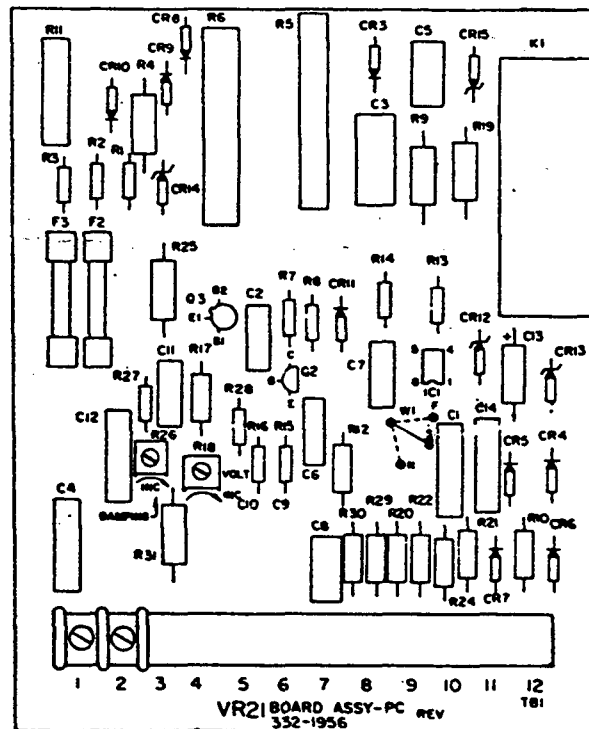
REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION	REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-1404	1	Board Assembly, Complete	R5	350-0466	1	Resistor (2 Megohm, 1/2 Watt)
C1	356-0039	1	Capacitor, Electrolytic (100 Mfd, 10 Volt)	R6	351-0202	1	Resistor, Film (1,240-Ohm, 1/4 Watt)
C2,6	355-0006	2	Capacitor (.47 Mfd, 100 Volt)	R7	350-0445	1	Resistor (270,000-Ohm, 1/2 Watt)
C3,7	355-0005	2	Capacitor (.22 Mfd, 200 Volt)	R8,10	350-0435	2	Resistor (100,000-Ohm, 1/4 Watt)
C4,5,11	355-0015	3	Capacitor (.1 Mfd, 200 Volt)	R9	350-0459	1	Resistor (1 Megohm, 1/2 Watt)
C8	355-0016	1	Capacitor (1 Mfd, 100 Volt)	R11,12	353-0048	2	Resistor, Wire Wound (4,000-Ohm, 5 Watt)
C9	355-0031	1	Capacitor (.39 Mfd, 100 Volt)	R13	351-0293	1	Resistor, Film (11,000-Ohm, 1/4 Watt)
C10	355-0017	1	Capacitor (.47 Mfd, 400 Volt)	R14	350-0363	1	Resistor (100-Ohm, 1/2 Watt)
CR1	359-0036	1	Diode, Zener (5.6 Volt)	R15,17	350-0351	2	Resistor (33-Ohm, 1/2 Watt)
CR2	359-0025	1	Diode, Zener (20 Volt)	R18	351-0332	1	Resistor, Film (28,000-Ohm, 1/4 Watt)
CR3,4,6-11	357-0004	8	Rectifier, Diode (400 Milliamp, 400 Volt)	R19	351-0240	1	Resistor, Film (3,090-Ohm, 1/4 Watt)
CR5	359-0026	1	Diode, Zener (18 Volt)	R20	351-0211	1	Resistor, Film (1,530-Ohm, 1/4 Watt)
CR12,14,15	357-0028	3	Rectifier, Diode	R21	351-0234	1	Resistor, Film (2,670-Ohm, 1/4 Watt)
CR13,16	365-0002	2	Rectifier, Gate Control	R22	350-0973	1	Resistor, Film (270-Ohm, 2 Watt)
E1-14	332-1511	14	Terminal, Lug	R23	350-0512	1	Resistor (10-Ohm, 1/2 Watt)
E15-16	363-0069	2	Heatsink, Diode	R24	351-0353	1	Resistor, Film (46,400-Ohm, 1/4 Watt)
H1	812-0029	2	Screw, Round Head (4-40 x 3/8")	R25	351-0349	1	Resistor, Film (42,200-Ohm, 1/4 Watt)
H2	526-0257	2	Washer, Flat (#4)	R26	303-0208	1	Potentiometer (20,000-Ohm)
H3	860-0003	2	Nut, Hex (4-40)	R27	303-0207	1	Potentiometer (5,000-Ohm)
IC1	367-0005	1	Integrated Circuit	R28	350-0355	1	Resistor (47-Ohm, 1/2 Watt)
MP1-2	517-0127	2	Cover, Potentiometer				
Q1	362-0017	1	Transistor, NPN				
Q2	361-0003	1	Transistor, Unijunction				
R1	350-0423	1	Resistor (33,000-Ohm, 1/2 Watt)				
R2	350-0443	1	Resistor (220,000-Ohm, 1/2 Watt)				
R3	350-0447	1	Resistor (330,000-Ohm, 1/2 Watt)				
R4	350-0398	1	Resistor (3,000-Ohm, 1/2 Watt)				

**VOLTAGE REGULATOR BOARD (Keys 1,4,5
Prior to Serial Number E760133373 During Spec AA)**



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION	REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	300-1006	1	Board Assembly, Complete	R5	350-0466	1	Resistor (2 Megohm, 1/2 Watt)
C1	356-0039	1	Capacitor, Electrolytic (100 Mfd, 10 Volt)	R6	351-0202	1	Resistor, Film (1,240-Ohm, 1/4 Watt)
C2,6	355-0006	2	Capacitor (.47 Mfd, 100 Volt)	R7	350-0445	1	Resistor (270,000-Ohm, 1/2 Watt)
C3,7	355-0005	2	Capacitor (.22 Mfd, 200 Volt)	R8,10	350-0435	2	Resistor (100,000-Ohm, 1/4 Watt)
C4,5,11	355-0015	3	Capacitor (.1 Mfd, 200 Volt)	R9	350-0459	1	Resistor (1 Megohm, 1/2 Watt)
C8	355-0016	1	Capacitor (1 Mfd, 100 Volt)	R11,12	353-0048	2	Resistor, Wire Wound (4,000-Ohm, 5 Watt)
C9	355-0031	1	Capacitor (.39 Mfd, 100 Volt)	R13	351-0293	1	Resistor, Film (11,000-Ohm, 1/4 Watt)
C10	355-0017	1	Capacitor (.47 Mfd, 400 Volt)	R14	350-0363	1	Resistor (100-Ohm, 1/2 Watt)
CR1	359-0036	1	Diode, Zener (5.6 Volt)	R15,17	350-0351	2	Resistor (33-Ohm, 1/2 Watt)
CR2	359-0025	1	Diode, Zener (20 Volt)	R18	351-0332	1	Resistor, Film (28,000-Ohm, 1/4 Watt)
CR3,4,6-11	357-0004	8	Rectifier, Diode (400 Milliamp, 400 Volt)	R19	351-0240	1	Resistor, Film (3,090-Ohm, 1/4 Watt)
CR5	359-0026	1	Diode, Zener (18 Volt)	R20	351-0211	1	Resistor, Film (1,530-Ohm, 1/4 Watt)
CR12,14,15	357-0028	3	Rectifier, Diode	R21	351-0234	1	Resistor, Film (2,670-Ohm, 1/4 Watt)
CR13,16	365-0002	2	Rectifier, Gate Control	R22	350-0973	1	Resistor, Film (270-Ohm, 2 Watt)
E1-14	332-1511	14	Terminal, Lug	R23	350-0512	1	Resistor (10-Ohm, 1/2 Watt)
E15-16	363-0069	2	Heatsink, Diode	R24	351-0353	1	Resistor, Film (46,400-Ohm, 1/4 Watt)
H1	812-0029	2	Screw, Round Head (4-40 x 3/8")	R25	351-0349	1	Resistor, Film (42,200-Ohm, 1/4 Watt)
H2	526-0257	2	Washer, Flat (#4)	R26	303-0168	1	Potentiometer (5,000-Ohm)
H3	860-0003	2	Nut, Hex (4-40)	R27	303-0164	1	Potentiometer (8,000-Ohm)
IC1	367-0005	1	Integrated Circuit	R28	350-0355	1	Resistor (47-Ohm, 1/2 Watt)
MP1-2	517-0127	2	Cover, Potentiometer				
Q1	362-0017	1	Transistor (NPN)				
Q2	361-0003	1	Transistor, Unijunction				
R1	350-0423	1	Resistor (33,000-Ohm, 1/2 Watt)				
R2	350-0443	1	Resistor (220,000-Ohm, 1/2 Watt)				
R3	350-0447	1	Resistor (330,000-Ohm, 1/2 Watt)				
R4	350-0398	1	Resistor (3,000-Ohm, 1/2 Watt)				

PRINTED CIRCUIT BOARD (Keys 6,7)



REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION	REF. NO.	PART NO.	QTY. USED	PART DESCRIPTION
	332-1956	1	Board Assembly, Printed - Complete	R7	350-0398	1	Resistor - 1/2 Watt, 3,000-Ohm
C1,14	355-0042	2	Capacitor - 47 Mfd, 250 Volt	R8, R16	350-0447	2	Resistor - 1/2 Watt, 330,000-Ohm
C2, C7	355-0043	2	Capacitor - 22 Mfd, 250 Volt	R10	351-0885	1	Resistor - 1/2 Watt, 51,100-Ohm
C3	355-0047	1	Capacitor - 47 Mfd, 400 Volt	R9,R11	352-0151	2	Resistor - Fixed 5 Watt 15,000-Ohm
C4, C12	355-0044	2	Capacitor - 47 Mfd, 250 Volt	R12	351-0909	1	Resistor - 1/2 Watt, 90,900-Ohm
C5, C8	355-0046	2	Capacitor - 1 Mfd, 100 Volt	R13	350-0411	1	Resistor - 1/2 Watt, 10,000-Ohm
C6	355-0056	1	Capacitor - .33 Mfd, 250 Volt	R14	350-0443	1	Resistor - 1/2 Watt, 220,000-Ohm
C11	355-0048	1	Capacitor - 1 Mfd, 400 Volt	R15, R27	350-0435	2	Resistor - 1/2 Watt, 100,000-Ohm
C13	356-0039	1	Capacitor - Electrolytic 100 Mfd, 10 Volt	R17	351-0293	1	Resistor, Metal Film - 1/4 Watt, 11,000-Ohm
CR3				R18	303-0210	1	Potentiometer - 5,000-Ohm, 1/2 Watt
Thru 11	357-0014	9	Rectifier - Silicon	R20, 22			
CR12	359-0036	1	Diode - Zener 5.6 Volt	29 & 30	351-0520	4	Resistor - 1/4 Watt, 28,000-Ohm
CR13	359-0025	1	Diode - Zener 20 Volt	R21	351-0522	1	Resistor - Metal Film - 1/4 Watt, 5,110-Ohm
CR14	359-0026	1	Diode - Zener 18 Volt	R24	351-0523	1	Resistor - Metal Film - 1/4 Watt, 8,870-Ohm
F2,F3	321-0204	2	Fuse, 1/4 Amp	R25, R31	350-1011	2	Resistor - 2 Watt, 10,000-Ohm
1C1	367-0005	1	Integrated Circuit	R26	303-0211	1	Potentiometer - 1/2 Watt, 100,000-Ohm
Q2	362-0017	1	Transistor - Silicon NPN	R28	350-0568	1	Resistor - 1/2 Watt .47 Meg-Ohm
Q3	361-0004	1	Transistor - Unijunction	TB1	332-1252	1	Terminal Block
R1	350-0355	1	Resistor - 1/2 Watt, 47-Ohm	CR15	359-0015	1	Diode - Zener - 24 Volt
R2, R3	350-0351	2	Resistor - 1/2 Watt, 33-Ohm		321-0163	6	Clip - Fuse
R4	350-1075	1	Resistor - 2 Watt, 4.7 Meg-Ohm	K1	307-1063	1	Relay, Magnetic Reed
R5	353-0040	1	Resistor - Fixed 10 Watt, 270-Ohm	R19	350-1007	1	Resistor - 2 Watt, 6,800-Ohm
R6	353-0039	1	Resistor - Fixed 15 Watt, 5,000-Ohm				